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Largest Issue Ever

The year 1966 has been a busy—perhaps we should say a hectic—one for "ELECTRONICS Australia." Month after month, we have had to produce what, last year, would have been record issues, culminating this month in what is far and away the largest issue ever. In fact, with 196 pages and a circulation nudging 50,000, it is probably historic in being the largest gross printing yet of any Australian magazine in the electronic or other technological field.

The onerous task of producing the issue has been ours, but the support which has made it possible has come from the Australian electronics industry, and for this we are duly grateful.

For economic reasons, the growth rate of a technical journal and the man-hours it can devote to producing relevant editorial features are closely related to the advertising support it receives. This is related, in turn, to the standing and acceptance of the journal, the financial situation of the relevant industry and, no less important, the degree to which the industry is publicity conscious.

Over and above the increased advertising support, it is most encouraging to record the number of technical stories, pictures and news pars, which have been submitted to us in recent months. This is making it possible for us to give increasing emphasis to the local scene and thereby more to justify the word "Australia" in our title.

There is everything to be gained from fostering the image of local technological awareness and resource, both in terms of individual companies and the industry as a whole. During past years, a great many tears have been shed about equipment orders going overseas, when they might conceivably have been filled by local suppliers. In some degree, local companies have themselves to blame for having been altogether too reticent about their accomplishments.

One of the effective ways of arresting the drift is to counter the welter of overseas literature with a constant flow of publicity for what we can do right here in our own backyard!

But enough of the moralising. May we extend to readers and advertisers the compliments of the Christmas season and express our hope for a prosperous and happy association during 1967.

N. Williams

December, 1966

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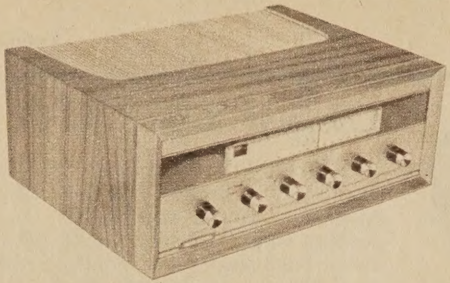
COVER PICTURE: Eight-year-old Mark Irving, of Avalon Beach, N.S.W., is not on the set of a science-fiction movie. He is looking at a real-life array of 900,000 volt compensating reactors in the Plessey Component Group's High Voltage Testing Laboratories at the Ducon plant at Villawood, N.S.W. (See story inside).

Everything for the Audio Enthusiast at . .

BROADWAY ELECTRONICS



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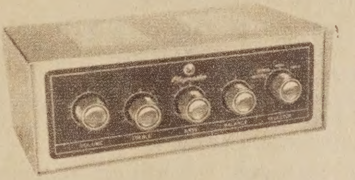
INSTROL-PLAYMASTER No. 4 STEREO AMPLIFIER ("Radio, Television and Hobbies," May, 1962). A high-quality 9-watt-per-channel Stereo Amplifier. The No. 4, and all others in the Instrol-Playmaster range, are precisely to this magazines' original specifications.



Kit of parts, **$73**
Built and tested,
$93.80

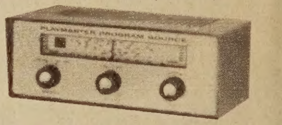
INSTROL-PLAYMASTER No. 106 STEREO AMP/TUNER ("Radio, Television and Hobbies," December, 1963). No. 4 Amplifier and No. 111 Tuner in combination make this high-quality Play- master No. 106.
Kit of parts, **$96.50**
Built and tested,
$117.30.

INSTROL-PLAYMASTER No. 113 AMPLIFIER ("Electronics Australia," March, 1966). A high-quality 8-watts-per channel transistorised Stereo Amplifier. Available with control units 112 to suit various applications.

Kit of parts, **$64**
Built and tested,
$84.
112 Control Unit
(picture above)
Kit of parts, **$51**
Built and tested,
$67

INSTROL-PLAYMASTER TUNERS.

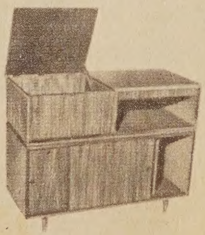
No. 111 Program Source Tuner ("Electronics Australia," October, 1965).
Kit of parts (with Magic Eye), **$39**
Built and tested (Magic Eye), **$53**



No. 114 Tuner with R.F. STAGE ("Electronics Australia," September, 1966).

Kit of parts (with Magic Eye)	**$47.00**
Built and tested (Magic Eye)	**$71.80**

INSTROL . . . *fine audio furnitur*



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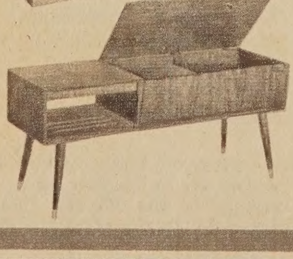
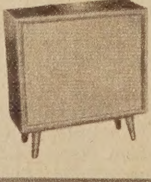
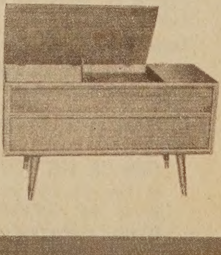
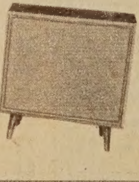
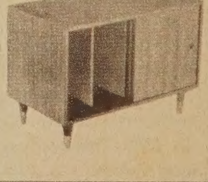








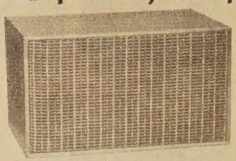


THREE FINE BOOKSHELF STYLE SPEAKER SYSTEMS

Each produced precisely to specification

Left:
The new M.S.P. "SHELF" enclosure with 4in and 8in newly developed speakers.

Price, per unit,
$49.50.



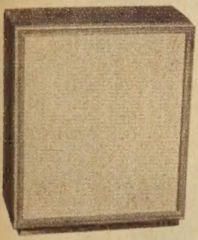
Centre:
The MINI-SPEAKER System as per the original Mullard and Magnavox specifications.

Price, per unit .. **$27.90**

Right:
The well-known INSTROL-PLAYMASTER BOOKSHELF SYSTEM —designed "R.T.V. and H." Dec., 1964. An efficient, compact, high-quality system.

Price, per unit,
Kit of parts, **$28**
Built and tested,
$35.80.

INSTROL SPEAKER SYSTEMS & ENCLOSURES



INSTROL high quality cabinets, cover a wide range of speaker enclosures, all designed to the specifications laid down by the various Speaker Manufacturers. The Kits are complete with grille cloth, Innerbond acoustic wadding and assembly instructions.

Left: Vented enclosures, ideal for use with 8in and 10in Wharfedale and Goodmans Speakers.

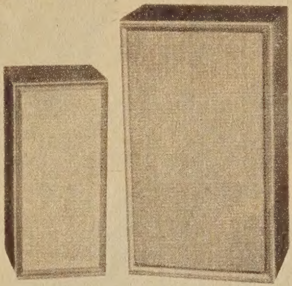
Price:

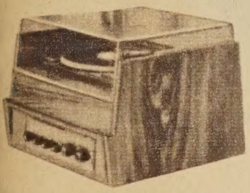
Complete Kit of Parts	Maple	**$20.00**
	Teak	**$22.70**
Built and Polished	Maple	**$35.00**
	Teak	**$38.00**

Right: Distributed part (D.P.) Enclosures to the original Wharfedale Specifications.

Price:

8in D.P. Kit of Parts	Maple	**$15.80**
	Teak	**$17.00**
Built and Polished	Maple	**$29.50**
	Teak	**$31.50**
10in or 12in D.P. Kit of Parts ..	Maple	**$26.50**
	Teak	**$29.00**
Built and Polished	Maple	**$44.00**
	Teak	**$45.90**



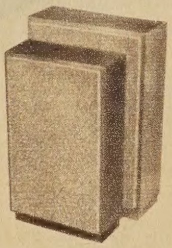


Left:
A new Instrol cabinet design which has a wide range of applications. Primarily it is intended to take an amplifier and a player. It is large enough to take combinations of most makes of imported and local players and amplifiers. All Playmaster amplifiers will fit. The front panel is removable to facilitate amplifier fitting. A perspex cover, with stay-up hinges, covers the player section.

PRICE .. Maple or Walnut .. .. **$37.50** Teak **$40.00**

Right:
Instrol Slimline Enclosures.
Designed on the D.P. principle, these speaker enclosures are suitable for most types of 8in, 10in and 12in speakers. Compact, only 6in and 7in deep.

PRICE: 8in Slimline Kit of Parts	Maple	**$11.00**
	Teak	**$12.20**
Built and Polished	Maple	**$21.50**
	Teak	**$22.70**
10in and 12in Slimline Kit of Parts	Maple	**$13.80**
	Teak	**$15.20**
Built and Polished	Maple	**$24.00**
	Teak	**$25.40**



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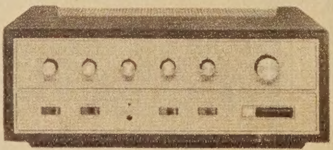
Yes, we carry a range of imported loudspeakers, players, amplifiers and tape recorders. Please state your requirements and we will gladly quote. All well-known brands stocked, **Wharfedale, Goodmans, Elac, Sony, Fisher, Akai, etc.**



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THE PROGRAMME — FEBRUARY 1967 — JANUARY 1968

FEBRUARY

ST1. TCHAIKOVSKY: SWAN LAKE

Tchaikovsky's immortal melodies splendidly played by Sinfonia of London, conducted by John Hollingsworth. Playing time 50 minutes.

ST2. SCHUBERT: "TROUT" QUINTET

Played by members of the Fine Arts Quartet, with Frank Glazer, piano, and Harold Siegel, double bass. Playing time 36 minutes.

ST3. HAYDN: CONCERTOS

Trumpet Concerto; Concerto for two Horns; Concerto for Organ. Soloists and Jean-Francois Paillard Orchestra, conducted by Paillard. Playing time 54 minutes.

ST4. STRAVINSKY: PETROUCHKA

The original version of the complete ballet. The London Symphony Orchestra conducted by Sir Eugene Goossens. Playing time 34 minutes.

MARCH

ST5. SIBELIUS: VIOLIN CONCERTO, ETC.

Concerto for Violin and Orchestra; Tone Poem: Tapiola. Tossy Spivakovsky and the London Symphony Orchestra, conducted by Tauno Hannikainen. Playing time 46 minutes.

APRIL

ST6. ANTILL: CORROBOREE

Antill's famous ballet suite Corroboree is backed by Grofe's Grand Canyon Suite — with the London Symphony Orchestra conducted by Sir Eugene Goossens in the former, and the Rochester Philharmonic conducted by the composer in the latter. Playing time 49 minutes.

MAY

ST7. DELIBES: SYLVIA/COPPELIA

Two intensely melodic ballet suites, with the R.I.A.S. Symphony Orchestra, conducted by Georges Sebastian and Anatole Fistoulari. Playing time 41 minutes.

ST8. GRIEG: PEER GYNT SUITES

The only complete recording of the incidental music to Peer Gynt. With April Cantelo (soprano) and the Royal Philharmonic Orchestra, conducted by Alexander Gibson. Playing time 45 minutes.

ST9. KHACHATURIAN: GAYNE BALLET SUITE

One of the most fiery and exciting of modern ballet suites. With the London Symphony Orchestra conducted by Anatole Fistoulari. Playing time 46 minutes.

ST10. BERLIOZ: GRANDE SYMPHONIE FUNEBRE ET TRIOMPHALE

Famous premiere recording from the Chorale Populaire de Paris and Musique des Gardiens de la Paix, conducted by Desire Dondeyne. Playing time 34 minutes.

JUNE

ST11. NEGRO SPIRITUALS

Famous WRC record with: Jericho; No
Knows; Little David; Motherless Child; G
Train; Shadrach; He's Got the Whole Worl
His Hands; Go Down Moses; Deep R
Heaven; Swing Low; Standing in the Nee
Prayer; Etc. Playing time 42 minutes.

JULY

ST12. TCHAIKOVSKY: NUTCRACKER SUITE

All the best-loved extracts. Sinfonia of Lon
conducted by John Hollingsworth. Playing
45 minutes.

AUGUST

ST13. GILBERT AND SULLIVAN OVERTURES

The Royal Philharmonic, conducted by Ken
Alwyn, presents overtures to Mikado; The
doliers; The Pirates of Penzance; H.M.S.
fore; Yeomen of the Guard; Iolanthe; Patie
Playing time 44 minutes.

ST14. VIVALDI: CONCERTOS

Concerto for two Trumpets; for Piccolo;
Violin and Oboe; for two Violins and two Ce
for Violin and Organ. Soloists and the J
Francois Paillard Orchestra. Playing time
minutes.

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JORGE BOLET: CHOPIN
TAL

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Manuel DE FALLA:
in the Gardens of Spain/Love the n.

vadeneira (soloist in "Love") and Alicia rrocha (soloist in "Nights") with stre des Concerts de Madrid, conducted ıs Arambarri. Playing time 51 minutes.

EMBER

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te and original version. The Jean-Fran-ıillard Orchestra, conducted by Paillard. time 47 minutes.

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amous version by Sibelius protege. Sin-of London, conducted by Tauno Hanni-Playing time 43 minutes.

MBER

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ERTO/DIVERTIMENTO

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The most famous of all Australian records. With the Sydney Symphony Orchestra and Choir, conducted by Sir Bernard Heinze. The Three Drovers; Christmas Bush for His Adorning; The Carol of the Birds; A Country Carol; Sing Gloria; Noel Time; The Little Town Where Christ was Born; Etc. Playing time 35 minutes.

ST21. DEBUSSY/PROKOFIEV/RAVEL

Ravel's Bolero; Ravel's Pavane pour une infante defunte; Debussy's Prelude to the Afternoon of a Faun; Prokofiev's Suite from Love of Three Oranges. The Hamburg State Philharmonic conducted by Pierre Dervaux. Playing time 53 mins.

ST22. TCHAIKOVSKY: SLEEPING BEAUTY

The most delicately beautiful of all classical ballets. With Sinfonia of London, conducted by John Hollingsworth. Playing time 52 minutes.

DECEMBER

ST23. CHORAL CLASSICS

Hear My Prayer; How Lovely Are Thy Dwellings; Ave Verum (Mozart); Cantata: In Windsor Forest (Vaughan-Williams); Te Deum Laudamus; Jerusalem. Elsie Morison, soprano, the Bach Choir and Jacques Orchestra directed by Reginald Jacques. Playing time 45 minutes.

JANUARY

ST24. HANDEL: ROYAL FIREWORKS MUSIC, ETC.

Magnificent recording by the Jean-Francois Paillard Orchestra of the complete and original Fireworks Music, plus Double Concerto No. 27 for Two Wind Choirs and Strings; and Oboe Concerto No. 10. Playing time 46 minutes.

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FEBRUARY 1967—JANUARY 1968.

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FEBRUARY
☐ ST1
☐ ST2
☐ ST3
☐ ST4
MARCH
☐ ST5
APRIL
☐ ST6
MAY
☐ ST7
☐ ST8
☐ ST9
☐ ST10

JUNE
☐ ST11
JULY
☐ ST12
AUGUST
☐ ST13
☐ ST14
☐ ST15
☐ ST16
SEPTEMBER
☐ ST17

OCTOBER
☐ ST18
NOVEMBER
☐ ST19
☐ ST20
☐ ST21
☐ ST22
DECEMBER
☐ ST23
JANUARY
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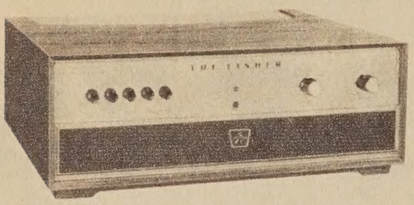

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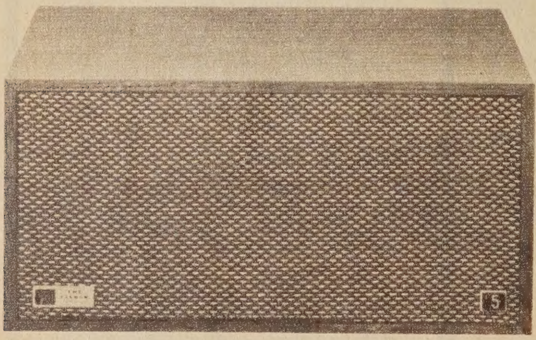

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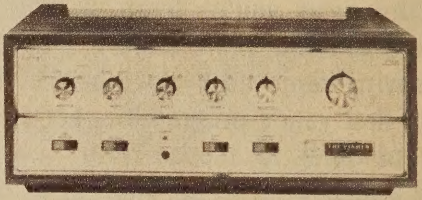

The Fisher X-100-A
40-Watt Stereo Control-Amplifier

with large output transformers, advanced control featu
front-panel headphone jack, complete phono and
facilities: **$240.**

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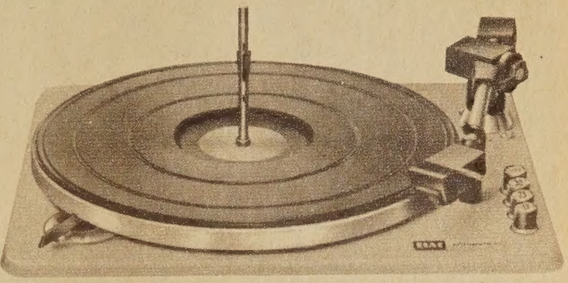

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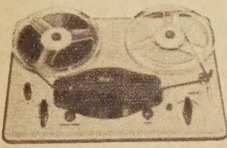

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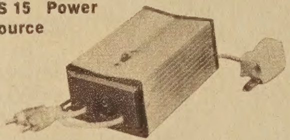

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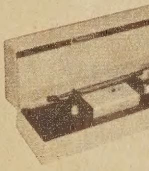
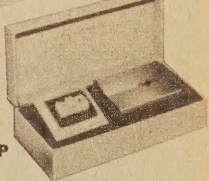


TK-15-LS/TK-15-P



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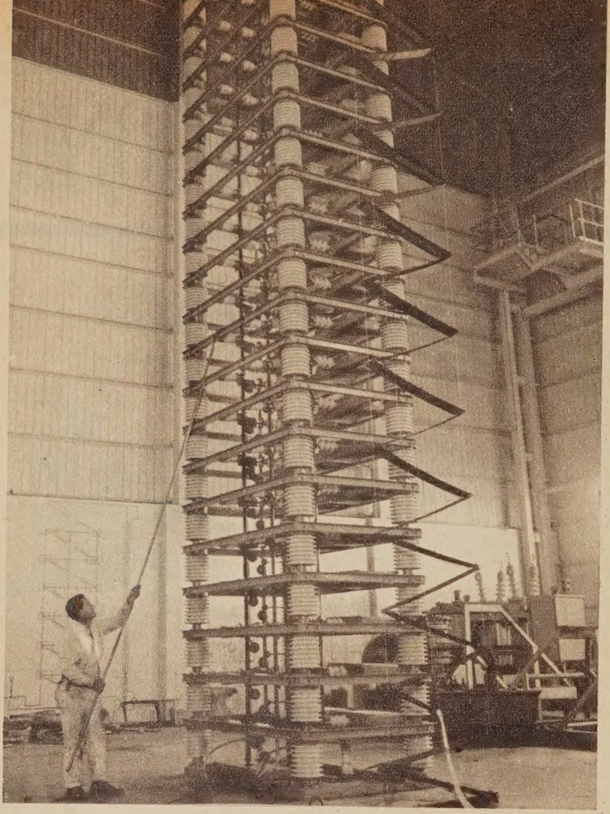
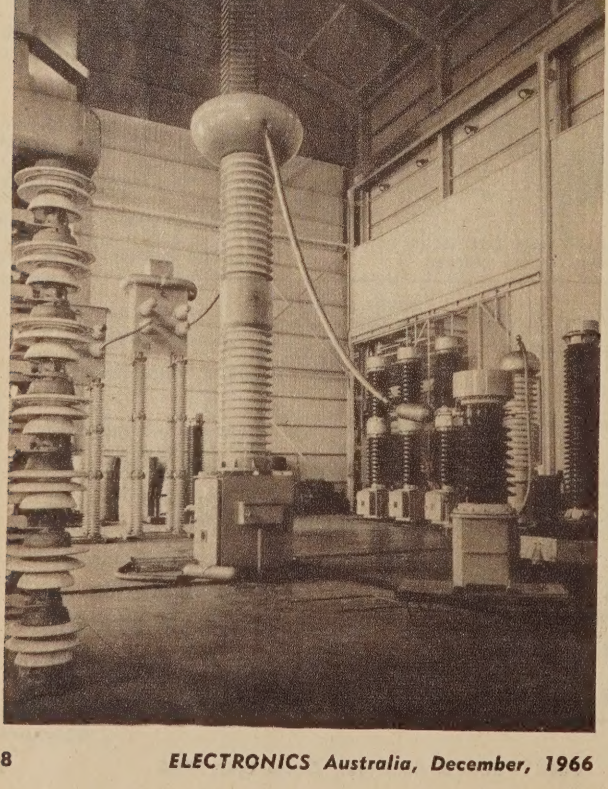


Above: A laboratory assistant works on the 3,000,000 volt impulse generator used in the simulation of lightning strikes. With few modifications it can be used to test equipment for a 700,000 volt transmission system.

Below: A 900,000 volt instrument transformer (centre) is coupled to a current transformer (on raised platform at right) in readiness for a test. To the rear and left of the instrument transformer is a high voltage reactor.



VOLTS BY

In a 10,000 sq. ft. building at Villawood, N.S.W., is housed one of the world's most comprehensive high voltage test laboratories. Available are facilities for testing transmission components associated with power lines operating at a half-million volts and beyond. Storm conditions can be simulated, with three-million volt lightning strikes.

Demand for electric power in Australia is incre ing at a rate which is one of the fastest in the Weste world. In fact, the growth-rate of Australia's electric consumption is now far higher than the rate of popu tion expansion. It has been estimated that output of el tricity must double every seven years or so to keep pa with demand.

Transmission of this ever-increasing amount power from generating stations to main distributi centres is effected at very high voltages, ranging curre ly up to 330,000 volts. In the not-too-distant future, Au tralia will have one of the highest electrical voltage tra mission systems in the world, when Victoria completes 500,000-volt transmission line.

The spectacular growth of power consumption h created the need for major test and evaluation faciliti to cater for electricity supply authorities and Australi manufacturers of high voltage transmission equipme Not surprisingly, the various State and semi-governme tal power authorities require a scrupulous standard dependability in the high voltage equipment used in the systems.

Some facilities for testing extra-high voltage equi ment exist in the University of Queensland and with the Electricity Commissions of N.S.W. and Victori However, among the leading test services available Australian electrical manufacturers and power bodies a those housed in a 10,000 sq. ft. building at Villawoo N.S.W., where Australia's (and one of the world's) mo comprehensive high voltage test laboratories are locate The laboratories are operated by the Ducon Pow Equipment Division of the Plessey Components Group.

In addition to their present capability, the Duc laboratories are geared to handle tests on equipment fo the 500,000-volt system to be installed by the State Ele tricity Commission of Victoria during the next fe years.

The Ducon laboratories function as part of a manufacturing undertaking which is itself a principal supplie of components to the power industry. In addition, th laboratories are available to power authorities and t other high voltage equipment manufacturers for produ testing purposes. In the last four years, 12 manufacturin companies, apart from Ducon, have made use of th laboratories.

These large-scale test facilities were established i 1961 and conduct what is known as "type" testin "routine" testing and research and development testin

"Type" tests are made by a manufacturer to prov that the design of an item of high voltage equipmen (such as current transformer, capacitor, reactor, capacitor voltage transformer or potential transformer) complies with the customer's specification. The tests indicat whether the piece of equipment will perform in a satisfactory manner under both normal and adverse powe system conditions, such as would be encountered i switching surges or lightning strikes on transmission line particularly where heavy rain is involved. Normally

THE MILLION!

ype" tests need only be done once, unless the para- eters of design are amended radically.

A large proportion of the tests carried out at Villa- ood comes under the heading of "routine" testing. hese tests ensure that all products meet the previously entioned type specification.

Typical are the "routine" tests conducted on high oltage current transformers. These units are used in a ansmission system for the measurement of current flow- ıg through the lines and for the protection of associated quipment in the event of the current exceeding a safe mit. Because the current transformer is a series element f a transmission line, any failure can result in a break- own of the power supply.

The facilities cater adequately for all existing or nticipated requirements (at least for the next 10 years) f Australian power authorities. The Ducon test equip- ıent could, with minor modifications, meet the require- ıents of a 700,000 volt transmission system, should this ver be introduced.

Switching surges and lightning strikes are simulated ı the Ducon Laboratories by an impulse generator, vhich can deliver a peak open circuit voltage of ,000,000 volts and discharge with an energy of 56,000 oules. Each of 20 stages in the massive generator are onnected in parallel by charging resistances until a riggering circuit causes a voltage avalanche.

To copy perfectly the characteristics of a lightning trike, the impulse wave has to rise from 10 to 90 per ent of its peak amplitude in 1.2 microseconds. Then the tail" of the wave has to fall to 50 per cent of its peak n 50 microseconds.

When the generator is finally discharged across the est equipment, the current flowing through the earth oops can be in the order of many thousands of ımperes. Intricate earthing techniques ensure that the earth loop voltages do not give spurious displays in the neasuring and recording equipment.

The current wave-form through the test equipment s measured by a shunt which has to be virtually non- nductive and able to withstand the voltage developed ıcross it by the heavy fault currents it has to pass.

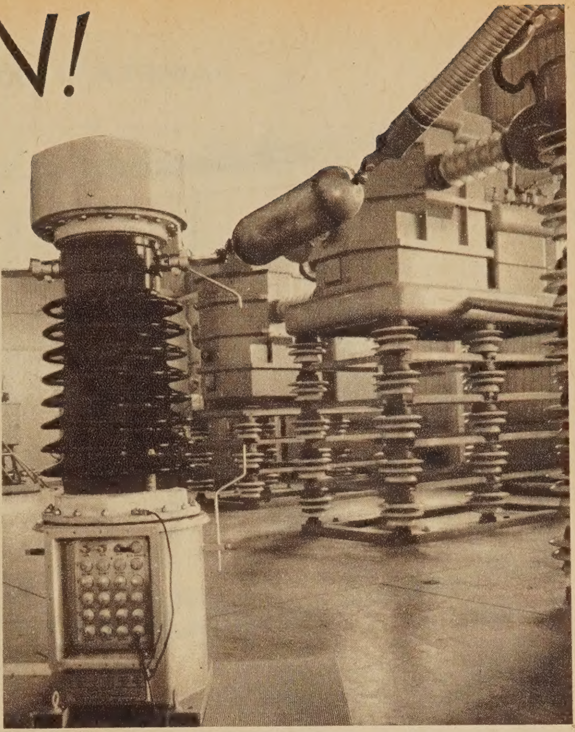
The actual voltage wave is measured by a voltage divider, the incremental voltage of which is displayed on ı cathode ray oscilloscope.

Apart from catastrophic failure, a transformer passes its "type" test if the shapes of its current and voltage wave-form characteristics (which are recorded on film) are identical at the start and finish of an established test program.

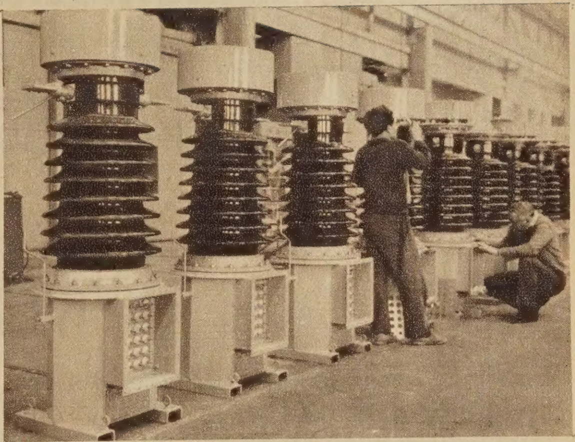
Another test applied to current transformers ensures that the major insulation has no manufacturing defects. This procedure is called the high voltage "withstand" test. In this instance, the voltage level is well in excess of the maximum anticipated voltage in service.

To carry out this test, the Ducon facility uses a 900,000 volt array of three 300,000 volt transformers connected in "cascade" fashion. The test can be made more rigorous by spraying the current transformer with water of a predetermined resistivity at a carefully controlled precipitation rate.

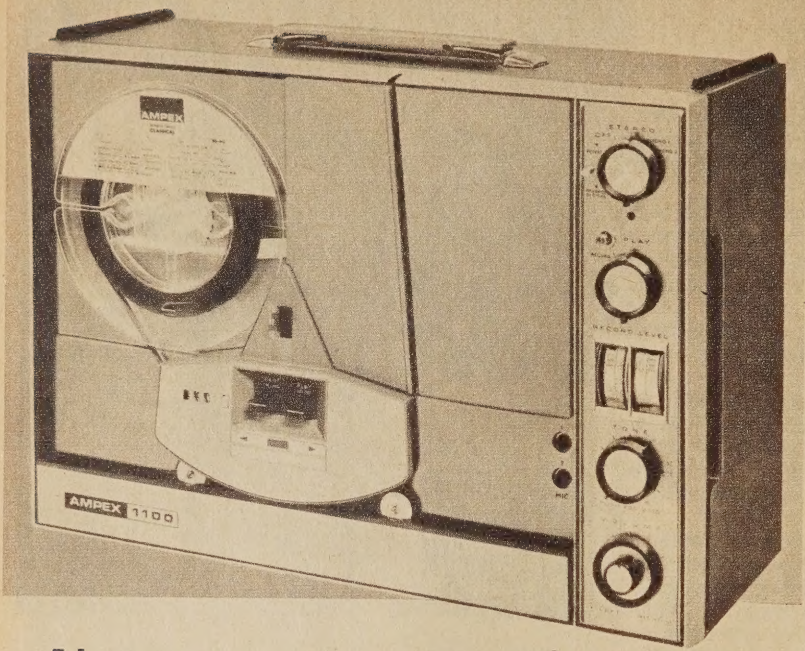
This test set-up can easily handle 500,000 volt



Above: A 66,000 volt current transformer is connected for test to 150,000 volts supplied by the transformer "cascade" at right. Below, a batch of 66,000 volt current transformers coming off the production line. (Photo, Ducon Industries).



Right: "Lightning" from the impulse generator discharges across the insulator on a 132,000 volt power line and photographed at the moment of impact on the support pole. (Photographs not otherwise acknowledged by courtesy of the Electricity Commission of NSW).



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AMPEX SCIENTISTS IN THE WORLD OF SOUND

equipment of all kinds and has frequently been used in tests involvin 680,000 volts.

The Ducon laboratories are currently experimenting with a technique known as the partial discharge measurement test. An extension of research carried out by the C.S.I.R.O., it helps detect very minute imperfections in insulation materials used in current transformers and other equipment. Very little is known of the long-term effect of partial discharges, bu it is known that items of equipmen can pass all high voltage tests and yet fail in service, perhaps because of water permeating the insulating oi or impregnated paper or some other minor, but cumulative, fault in design or material.

The partial discharge test requires infinite electronic pains, but is proving so effective as a quality control tool for spotting any manufacturing imperfections or inadequate processing that it bids fair to becoming a routine test required by Australian standards.

For example, in the testing of a 330,000 volt current transformer, a discharge of five picocoulombs is considered significant. Measuring such a discharge in these circumstances is really like looking for, finding and holding on to a greasy needle in a large haystack.

There are many refinements yet to be discovered and applied in the search for cheaper and more reliable high voltage equipment. The Ducon laboratories are undertaking research and development projects along these lines and are utilising chemical and physical test facilities available from within the Plessey Components Group.

BASIC RADIO COURSE

Our well-known "Basic Radio Course" is now available as a 128-page book, priced at $1.50, plus postage where applicable. For details, see page 89.

Research and development investigations being carried out at present include studies of increased dielectric stresses within power equipment, and the optimum geometrical shapes of ceramic insulators under conditions of high atmospheric pollution.

Because of the high capital cost structure of today's large power systems, it is of the utmost importance that power equipment functions effectively and be able to withstand years of exposure and abnormal weather conditions.

Quality equipment is the guardian of our power supply and on it we depend, in the final analysis, for the luxuries of domestic electricity and the continuity of industrial activity. The achievement of this quality is obtained by thorough and effective testing — such as is carried out by the Ducon facilities at Villawood. ◼

hat are the prospects and opportunities for

A CAREER IN ELECTRONICS?

What are the attractions of a career in electronics? How do I get started? Who can advise me on career opportunities in the industry? These and other questions will be in the minds of many young people leaving school this year. This article has been written by an electronics engineer who has been concerned with apprentice training in one of Australia's largest electronics factories for a number of years. It answers some of the questions commonly asked, and discusses some of the problems facing young people interested in a career in electronics.

Up till a few years ago, electronics nded to receive rather scant attention y young people considering possible areers. It was granted only passing ention in "Careers" booklets and, even oday, the coverage of electronics in any such booklets is meagre, mainly ecause their text has simply not kept ace with the tremendous growth rate f the electronics industry.

In fact, electronics is among the fast-st growing of all industries. It includes adio, television, sound reproduction, lecommunication but, more than that, provides the key to progress in most ther fields. Industrial automation and ontrol relies heavily on electronics; omputers are almost entirely electronic n operation; research and instrumentaion in all branches of science are winging to electronic techniques.

The scope is almost limitless.

The rapid growth of the industry has laced a heavy emphasis on training. No longer can young people expect to rift into good positions on the strength f a hobby interest or knowledge picked up randomly from a factory assembly ine.

A career in electronics must be chosen nd pursued as deliberately as in the onger-established occupations. It will most likely flow from a decision taken owards the end of secondary schooling, and prompted by the person's own natural interests and aptitudes.

In the past it has been normal for a tudent in his third year at secondary school to do an aptitude test and discuss the results with a Vocational Guidance Counsellor and his Career's Adviser. In the change to four- and six-year courses of secondary education, this nitial test may be delayed to the fourth year.

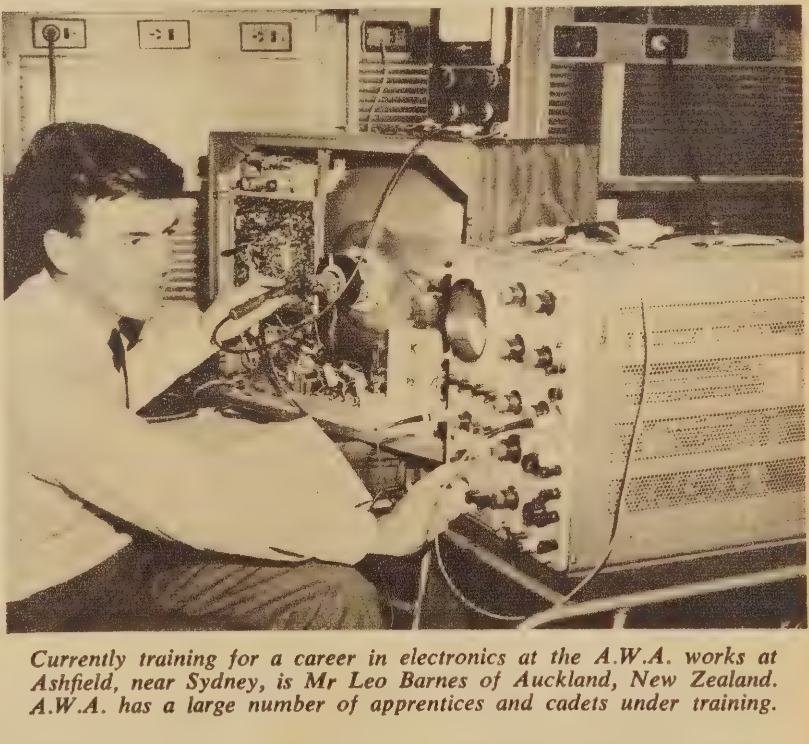
At this stage he is normally advised in broad terms of the various types of employment into which he could later move and expect a reasonable measure of success. However, and far more importantly, he will be advised whether he should carry his secondary education to the Higher Certificate level, which subjects he should take and which levels he should attempt.

A follow up vocational test is strongly recommended in the later stages of his final year at school so that a more specific report can be made available to him, showing courses of study within his scope and suggesting suitable starting points.

The choice of a career is a very important step in the life of any person — especially a young man. Many people show an aptitude for more than one kind of work, and on leaving school some youths are still undecided on what they want to do. While this poses a problem, it is not necessarily a reflection on their personality.

One thing is certain, however: In this period of indetermination young persons need all the assistance and advice they can get. Here are some of the steps they can take to help themselves during this very critical and often difficult period:

1. Ensure that Vocational Guidance counselling is sought in the third or fourth year at secondary school, and again just prior to leaving school.
2. Seek the advice of the school's Careers Adviser. Go to the Career's Night, held at many schools towards the end of the School Year. Here you will have the opportunity to talk with people experienced in many types of industries, professions and careers. Parents should make a point of attending with their child, and of taking the opportunity to talk with the Careers Adviser about the choice of a career.
3. As you begin to narrow down the choice, talk to people who have been successful in the type of careers in which you are interested. It is always wise to seek two or three opinions, as well-meant advice may not always present a complete or unbiased picture.
4. Consider seeking an interview while still at school, with one or more employers. This can be very helpful. They may even show you around and give you an idea of "what their business is all about."
5. Seek literature from universities or technical colleges in your area relative to the courses available.
6. During your last few months at school, go through the "Positions Vacant" columns of the newspapers. The object of this is not only to study the positions which might suit you and provide an opening into a desired career, but also to study the positions open to qualified people. The information so obtained will enable you to understand the opportunities and the obligations as you progress in the career you are contemplating. It will also give you some knowledge of the various companies in the field and the openings in Public Utilities, Government Departments and other "official" type organisations.



Currently training for a career in electronics at the A.W.A. works at Ashfield, near Sydney, is Mr Leo Barnes of Auckland, New Zealand. A.W.A. has a large number of apprentices and cadets under training.

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SINGLE SIDEBAND communications o four popular amateur radio bands (80 40, 20 & 15 meters) are offered in new transistorized transceiver from Side band Engineers, a unit of Raytheo Company. **Compact, 20-pound** SB-34 measures only 11¼" by 10" by 5" an can be operated as a base station o a mobile unit from either 117 volt AC or 12 volt DC. From SBE . . . **COMPLETELY NEW SIDEBAND TRANSCEIVER, SB-34!** All of the design features introduced originally in the SB-33, and now well proved, have been retained . . . an entirely new series of "plus performance" features have been added. And SB-34 is handsome equipment . . . conservatively styled, attractively appointed . . . is in a physical "package" that is even smaller than SB-33! Feature-wise . . . dollar-wise . . . **SB-34 LEADS THE FIELD** . . . represents the biggest transceiver value EVER! Here are some of the reasons:

SB-34 HAS A BUILT-IN UNIVERSAL POWER SUPPLY! Just connect the equipment directly to the vehicle 12 volt battery using the cable provided! Or use the second cable and plug it into 117 volt AC power supply. No inverters or other supplementary equipment needed.

LOW-DRAIN STANDBY OPERATION. Drain-saving panel switch turns off transmitter tube filaments and power supply for casual listening. In this condition, SB-34 draws only ½ ampere from the car battery!

UPPER OR LOWER SIDEBANDS ARE SELECTABLE BY PANEL SWITCH. The two sidebands are locked positively to the carrier — dial shift can't occur.

LOUDSPEAKER IS BUILT-IN.

A COLLINS MECHANICAL FILTER is used both on transmit and receive; gives exceptional selectivity and a clean, sharp transmitted signal.

EXPANDED FREQUENCY COVERAGE. SB-34 provides 250 kc on 80-40-20-15 meter bands, covers MARS and out-of-band DX frequencies. (See specifications for specific ranges.)

SOLID-STATE SWITCHING . . . NO RELAYS. In SB-34, all circuits are switched from receive to transmit by modern solid-state techniques — a breakthrough in transceiver design that eliminates all relays!

SOLID-STATE, ALC CONTROL.

SOLID STATE DIAL CALIBRATION: EXCLUSIVE! Varactor circuitry and control allows easy dial calibration to operating frequencies. SB-34 has provision for 100 kc crystal calibrator, includes calibrator ON-OFF front panel switch.

DELTA RECEIVER TUNING. With this feature receiver can be tuned over a range of several kilocycles either side of the transmitter frequency. This eliminates the "leap-frogging" problem.

LOW FREQUENCY DRIFT . . . Drift is normally less than 100 cycles in any 30 minute period under normal ambient conditions.

DUAL-SPEED TUNING. Shaft mechanism allows fast dial movement to desired part of the band and smooth, slow-speed drive for positive vernier tuning. Tuning system avoids dial shift under severe vibration.

SB-34 leads the field.

SPECIFICATIONS
FREQUENCY RANGE: 3775-4025 kc, 7050-7300 kc, 14.1-14.35 mc, 21.20-21.45 mc. TUBE AND SEMICONDUCTOR COMPLEMENT: 2—6GB5 power amplifier, 1—12DQ7 driver. 23—transistors, 18—diodes, 1—zener diode, 1—Varactor diode. SIZE: 5"H, 11¼"W, 10"D. Shipping weight, Approx. 20 pounds.

TRANSMITTER POWER INPUT: 135 watts. (Slightly lower on 15) DISTORTION PRODUCTS: Down at least 25 db. CARRIER SUPPRESSION:—50 db. SIDEBAND SELECTION: Upper or lower sideband selectable by panel switch. UNWANTED SIDEBAND: Down 40 db min @ 300 cps. ANTENNA IMPEDANCE: 40-100 ohms unbal. AUDIO BANDSWITCH: 300-2400 cps @ 6 db.

RECEIVER
SENSITIVITY: 1_{μ}V for 10 db signal/noise. SELECTIVITY: 2.1 kc @ 6 db, 5.3 kc @ 60 db. SPURIOUS RESPONSE: Images and IF response down at least 40 db. STABILITY: Less than 100 cps drift in any 30 minute period under any normal ambient condition. AUDIO OUTPUT: 2.0 watts @ 10% distortion. TUNING RATE: 14 kc per revolution (slow) 80 kc per revolution (fast). SPEAKER: 3.2 ohms built-in. Terminals on rear for external speaker. POWER SUPPLY: Built-in 117V AC/12V DC (negative ground) dual supply. Conversion is made automatically by proper line cord.

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AC OPERATION: 35 watts, receive. 165 watts transmit (single tone). DC OPERATION: 0.5A receive only. (Standby) 3.6A receive (xmtr ready) 16.0A transmit (single tone).

ACCESSORIES
● Model SB-2, VOX ● Model SB-2XC, 100 kc crystal calibrator ● Model SB1-MB mounting plate for mobile use ● Model SB-1MIC controlled magnetic microphone ● SB1-LA LINEAR AMPLIFIER. Operates at 1,000 P.E.P. input on 80, 40 and 20 meters, 750 watts on 15 meters. Size: 5½"H x 11¾"W x 11¾"D.

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Finally, there is the most impor- matter of salary to be considered. ot look for big money at the start. offering seemingly attractive mone- rewards for untrained persons are likely to lead to a worthwhile er. First, look for a position which 's opportunities for training and dance at a suitable course — then olidate yourself. From such sound nnings, you will find that security, ess and satisfaction will follow in course.

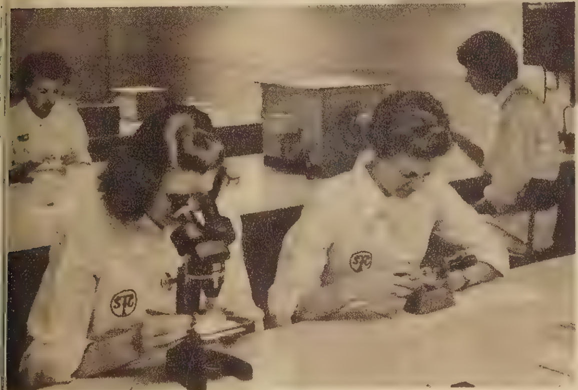
emember, job satisfaction is more ortant than salary — your health prosperity depend on it. A highly yet unhappy or unhealthy man is to be envied.

he author has attended many careers ts at High Schools, and has thereby ed first-hand knowledge of the kind question that occupies the mind of ng people seeking guidance. It may elpful to list some of these questions to answer them more or less in the they would be answered on such asions.

am uncertain whether I should stay chool—what should I do?"

n the case of uncertainty, you should earnest consideration to continuing at school, unless there are other rea- s (economic considerations, for mple) why you should not do so. If r School Counsellor considers that u could proceed to the Higher Certifi- te then you should do so, if this is at possible.

High standards of cleanliness are demanded in modern electronics factories. This workshop in the Fairchild semiconductor factory at Croydon, Victoria, has air filtration and air-conditioning units to ensure clean and stable atmospheric conditions.



Nowadays, there are many opportunities for women in the electronics field. Here a group of women are engaged in the manufacture of semiconductors at one of the S.T.C. factories in the Sydney area.

There are a lot of people in industry o regret very much that they did not atriculate while they were at school, that they could go on to University. e author has never met one who shed he had left school earlier and ed a lower level course first! Even if u do fail in the Higher Certificate amination, and have to take a lower vel course, at least you will have the tisfaction of knowing that you have, the process, determined the level at hich you can work.

Vhat courses are available in elec- onics?"

This is a big subject, and can only be vered briefly under several main head- gs.

Apprenticeships: Those seeking an dentured apprenticeship can attend a dio trades course, available at most ty and country areas in all Australian ates. In New South Wales, a pre- quisite demanded by the educational thorities is that the student be engaged in the relevant industry as an apprentice. It would be normal for him to have sat for, and to have passed, the lower School Certificate examination.

In general, an apprenticeship makes the least demands on a student academically, but it also offers the smallest facility for progressing beyond the tradesman level. However, an apprentice who has completed his trade training can still advance by going on to one of the higher courses.

Trades Certificate: A student who has gained the lower School Certificate or equivalent with passes in Mathematics at Credit Level, Science and English, or has otherwise satisfied entry requirements may alternatively be eligible for entry to a certificate course, such as the four-year Electronics and Communications Certificate course, available in whole or in part, at a limited number of technical colleges in New South Wales. This course proceeds to a higher academic level than the purely "Trades" course and involves approximately 10 hours a week lecture attendance.

While attending college, suitable employment must be considered, relevant to the training course. Many employers and organisations can offer suitable positions and, if there is a choice, preference should be given to the one which offers most opportunity for a wide range of workshop and laboratory training.

In the final year at college, you may have the option of specialising in radio communications, television or industrial electronics. There is usually no need to make up your mind which option to take until late in the third year, by which time you would be in a better position to decide. You may well decide to do an extra year and complete two options.

Students who have gained the Higher School Certificate or equivalent could still enrol in the Certificate Course and gain some exemptions in Stage 1 and possibly also in Stage 2. However, these students should consider the alternative of entering University, as discussed below.

University Degree. Provided you have met the matriculation requirements of the university concerned, you may become a university undergraduate, choosing one of the following courses:

Bachelor of Engineering In Electrical Engineering. This is a four-year full-time or seven-year part-time course in which you would choose an appropriate option in your final year (e.g. Communications).

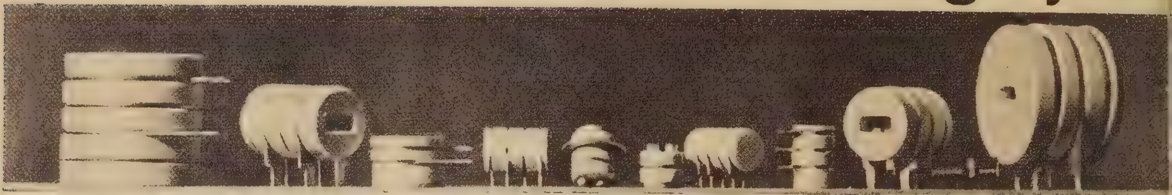
Bachelor of Science (Technology). A six-year part-time course, supplemented by training in industry of a kind considered suitable by the university.

Diploma Course. It is possible that a student may feel (following advice from the Vocational Guidance Counsellor at his school) that a full-scale university course would be beyond his capabilities. Or, possibly, he may not be able to satisfy the entrance requirements for the course of his choosing.

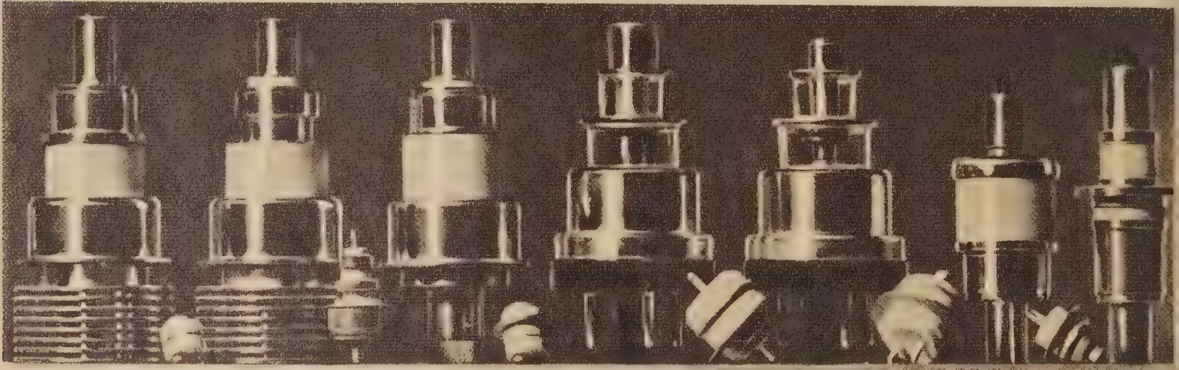
In this case, he could consider a Engineering Diploma, usually a part-time course of five years' duration, intended to be intermediate between the certificate and degree courses. This type of course is also available as an extension to students who have successfully completed the Electronics and Communications certificate course.

In these days of semiconductor electronics, the holder of a diploma will find many excellent openings in the electronics industry, although they may be

Do the tough jobs



with metal-ceramic



planar tubes from

General Electric

Classification	Type	Maximum Ratings Plate Dissipation (Watts)	 Current (milliamperes)	Typical Application	Useful Frequencies Extend to**
Triode (Class A Operation)	7077	1.0	$I_k = 10$	Low-noise UHF Amp.	3000 mc
	7768	5.5	$I_k = 30$	Low-noise VHF Amp.	3000 mc
	Y-1032	0.6	$I_k = 10$	Low-mu, Low-plate-voltage Osc., Amp. or Mult.	3000 mc
Triode (Class B or C Operation)	6897	100.0*	$I_k = 125$	UHF Power Amp., Osc. or Freq. Mult.	3000 mc
	7486	1.0	$I_k = 10$	UHF Power Amp., Osc. or Freq. Mult.	3000 mc
	7913	5.5	$I_k = 30$	UHF Power Amp., Osc. or Freq. Mult.	3000 mc
Triode (Pulse Operation)	6442	7.5*	$I_p = 2500$ $I_g = 1250$	Pulsed Oscillator or Amp.	6000 mc
	7815	100.0*	$I_p = 3000$ $I_g = 1500$	Pulsed Oscillator or Amp.	3000 mc
	7910	1.5	$I_p = 600$	Pulsed Oscillator	7500 mc
	7911	6.5	$I_p = 2500$	Pulsed Oscillator or Amp.	6000 mc

*At this dissipation level, anode cooling is usually necessary to prevent exceeding maximum permissible seal temperature.

**The frequency listed is one at which significant application data are available or expected. It does not represent an absolute frequency limit.

From DC to 10 gc, ceramic triodes are often the most practic way to achieve small size and weight . . . at low cost . without sacrificing performance. Sometimes they're the or way.

The construction of these General Electric tubes is plana terminals are integral parts of the structure. As a resu these tubes rate high in power output (milliwatts to 5 k peak). Low in noise (fractions of a db at low frequenc High in gain and wide in band (gain-bandwidth products to 5000 mc).

And when it comes to performance under adverse condition General Electric ceramic tubes are unsurpassed.

They tolerate temperatures as low as —55° C. or as high 400° C. These tubes withstand impact shocks of up to 6 G's for 3-5 m.sec. RMS vibration up to 48 G's (100-2000 cp 3 min. each plane). And they've tolerated nuclear radiati of 10^{18} NVT total integrated dose.

For full information on the whole line—only a fifth of it listed here—contact *Australian General Electric Pty. Ltd., 1 York Street, Sydney, 29-8711; 552 Lonsdale Street, Melbourn Vic., 67-8221.*

GENERAL ELECTRIC

TRADEMARK

ewhat more limited than those open the engineering graduate or B.Sc. h.).

Which is the best course to do?"

his depends on many factors. Prob- , the best advice is attempt a course ıe highest level available to you after idering the advice of your Voca- al Guidance Counsellor. If he sug- s that a degree course is within your bilities, then the choice between full- and part-time is dependent on the lability of a suitable cadetship and ibly on economic factors.

lad who is lacking in confidence in ual tasks, and possibly a little ner- s and tentative, may do better with a -time course, because of the practical ning received in industry at the same . In industry, with proper training, will tend to develop self assurance gain confidence as he learns to apply self to the manual tasks normally ciated with the early years of train-

well-balanced cadetship will include eriod of workshop training which is emely beneficial in many ways, and lad will learn to discipline himself. his training progresses, he will almost ainly find himself developing drive a much more confident approach. sibly parents would be in a better ition to judge the need for this side industrial training. Bear in mind that nay be possible to change over to the -time course after the second or rth year.

What exactly are cadetships and ineeships?"

Most major industrial concerns and ernment departments take on a num- of young men each year and pay ir way (according to an award) ough university or technical college. is is a means of recruiting potential gineers, technicians or tradesmen and very beneficial to young men bent entering such a course. Cadetships be divided into two classes:

1. **Full-time Cadetships.** The employer l pay your compulsory university s but may ask you to pay for any eat years yourself. He will also pay an allowance, possibly of the order $25 per week in the first year. He l expect you to work for him during annual university vacation period d also to do your practical training, the later years, with him.

He may ask you to enter into a nd, possibly for $1,000, to stay with n for two years after graduation.

Cadetships of this nature are keenly ught by young matriculates but, ually, promising matriculates are keen- sought by prospective employers.

2. **Part-time Cadetships.** The em- oyer will pay your compulsory uni- rsity fees but may ask you to pay for y repeat years yourself. He will also ant you time off to attend university normally two afternoons per week. the remaining time, you will work r him, but he will normally offer you ining which will complement your dies. In the final years, he will have u working with qualified engineers, ssibly assisting in development or even search.

Some employers may offer you a detship in which you attend university rt time for the first two years, then full time for two years, finishing off with one year part time. They may even suggest that, if you do well in the early years, you can (with the permission of the university) convert to the full time course to finish off.

Here again he will pay you, according to an award, a weekly wage which varies from approximately $25 in the first year to $52 in the sixth year. (The part time course is usually of six or seven years' duration.

Traineeships are normally offered to entrants into Certificate courses, and separate award scales will take into account the level reached at school. Training possibly emphasises the manual side more than in cadetships and fits the student to take his place as an Electronic Technician on completion of his course. A traineeship is similar to an apprenticeship except that there are no indentures, and training in the latter years normally would emphasise laboratory type work or possibly advanced constructions work and maintenance of complex equipment.

Conditions are normally somewhat similar to those for cadetships, with a slightly lower wage scale.

"Should I have shown an interest in Electronics?"

No, not necessarily. Some boys begin reading and experimenting in electronics at an early age. Others, however, may be steered toward electronics, among other things, by results of aptitude tests, possibly, but not necessarily coupled with a strength in mathematics and physics. At this time they must choose something in which they feel they could become interested.

Many successful electronic technicians and engineers are very happy in their work, but do not carry the interest into their private lives. Conversely, many people in other professions and industries spend quite a deal of their spare time "dabbling" in electronics.

"Are there any opportunities in electronics for young women?"

Nowadays, yes; particularly at the technician and engineering levels. While there was a certain prejudice by employers against women in the past, this attitude has all but faded away—both because the supply of qualified people in general lags behind the demand, and also because women have shown that they can make highly capable engineers and technicians.

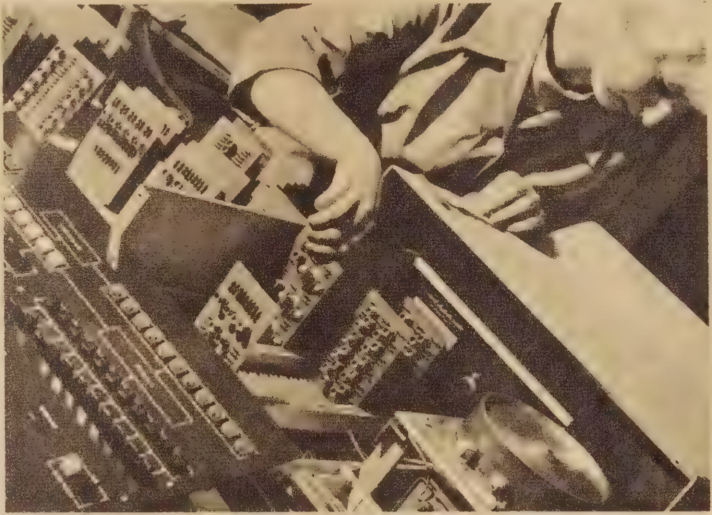
For the young woman with aptitude and interest in the field, electronics can offer a highly interesting and rewarding career. ■

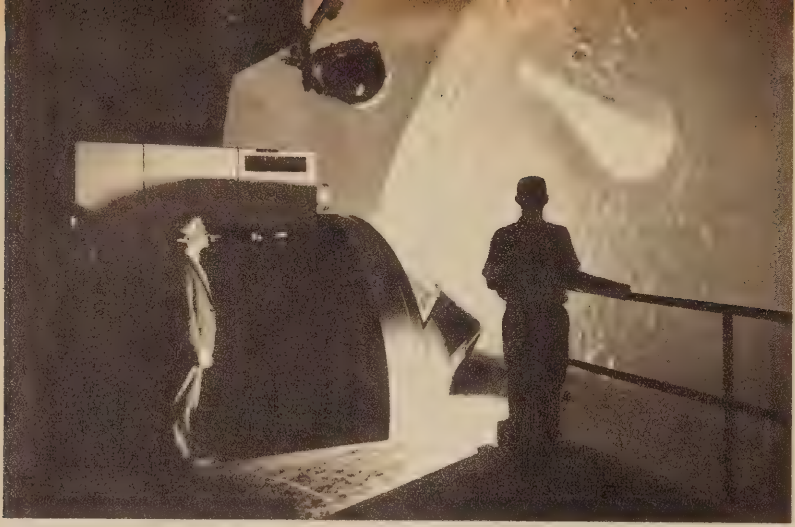
DIGITAL COMPUTER FOR SCHOOLS

In U.K., the electronics firm of Noble and Dowden Ltd. Krooner Road, Camberley, Surrey, has under construction a digital demonstration computer designed for educational use to show specifically the normal mode of operation of the modern digital machine.

The makers say that the machine, known as Nadec 1000, lacks no important functional parts. Although the word length has been kept short — 11 bits in binary code — and the instruction repertoire is small, both conditional and unconditional jump instructions are available. Also, a method of storing return addresses provides a realistic demonstration of entry to and exit from subroutines, so that students can learn the proper use of repetitive calculation. The total storage capacity of 128 words is adequate to demonstrate the operation of a single subroutine of some complexity.

The contents of all registers are displayed on lamps on the display panel (left side of picture below) and the machine can be stopped after each instruction has been completed. It can also be single-stepped to show the bit-by-bit movement of data through the registers.





Approaching the moon? No
really, just a scene in the Boein
Visual Space Flight Simulator
The training cockpit (centre fore
ground) is at the focus of a 30f
hemispherical screen on whicl
the images are projected.

Rapid Growth of Simulatior

By Calvin Walters

The technique of simulation is advancing rapidly. It is currently making significant contributions to space research, the aviation industry, defence and, in fact, wherever it is too dangerous, too difficult, or too expensive, to test equipment and train personel in a true environment. Our main story deals with current space research, with some additional comments on other fields.

As the race to put a man on the moon proceeds with gathering momentum, space research has become not only a top priority project but also very big business among the nations engaged in the race. Space simulation represents a major segment of the project and the following description of one of the largest laboratories in the world, the Boeing Space Research Laboratories, is of particular interest as a follow-up of the article on simulation in the issue of May 1966.

The Boeing Space Centre is situated in Kent, a few miles from Seattle, Washington, U.S.A. It is a $US20-million project, situated on a 320-acre site which provides ample room for expansion to keep pace with the nation's space exploration programs. The centre provides facilities for testing space vehicles for mission success before leaving earth, and simulation facilities for putting astronauts "through their paces" before embarking for outer space.

Simulation of space environment may be divided into two broad classifications: simulation of space conditions—
heat, cold, vacuum, radiation etc. —
order to evaluate the reaction of ma
ials and equipment and their ability
function in such conditions; and sim
tion of space flights—including
above-mentioned conditions—in orde
familiarise astronauts with the condit
they will encounter and teach them l
to react in all circumstances.

The Boeing Space Environment Si
tion Laboratory consists of 18,000 squ
feet of floor space with a staff of
engineers and technicians. There i
data processing system incorporatin
digital computer and a separate au
iary data logging system which rec
200 data channels in computer-com
ible format. There are 512 low sp
channels and 40 high speed chan
in the data processing system.

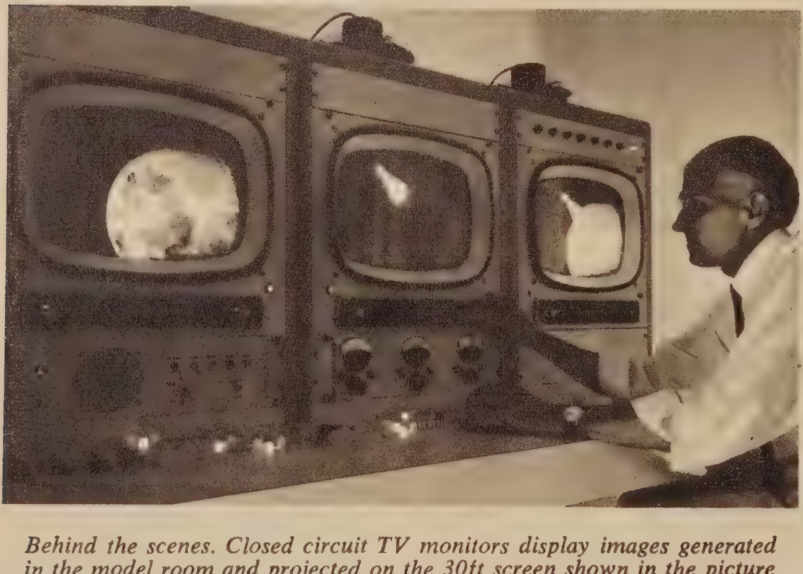
The laboratory contains 11 sp
simulation chambers varying in size f
39 feet down to 30 inches in diame
The 39 feet diameter chamber is
feet high, and is large enough to
full sized spacecraft. In it the sp
craft can be subjected to most of
conditions experienced in space such
extreme heat, freezing cold, intense s
radiation and high vacuum. A vacu
equal to that at an altitude of 400 m
can be obtained.

Super cold temperatures of mi
320 deg.F can also be produced.
is achieved by circulating liquid nitro
through black shrouds inside the ch
ber. An array of quartz lamps simul
solar radiation. With modifications
chamber can be used to test man
systems, called "Man-Rating," with c
puter controlled data acquisition syste
personnel entry air locks, and emerge
re-pressurisation systems.

There are other space simulation
vironment chambers designed for ma
ial evaluation and small component t
ing, and the laboratory is provided
devices to irradiate test specim
with simulated solar energy. Infra
energy radiated by all planetary bo
is simulated with radiant heat lam
These provide a complete heat load
the specimen.

Solar simulation is accomplished
using either carbon arc or xenon
sources. The carbon arc solar si
lator will irradiate an area 12 inc
in diameter with an intensity of m
than four suns if the light is collimat
that is projected into parallel rays,
an intensity of one sun with non-
limated light over an area of 24 inc
diameter. The xenon arc simulator
irradiate areas slightly less than
carbon arcs. The light is usually int
duced into the chamber through an u
violet grade quartz window.

In addition to the Space Envir



Behind the scenes. Closed circuit TV monitors display images generated in the model room and projected on the 30ft screen shown in the picture at the top of the page. Two separate images, left and centre, are shown combined on the right.

Laboratories there is a Materials
Processes Laboratory. Briefly this
0,000 square feet area of libraries,
ne shops, laboratory equipment,
, and offices. It is manned by 100
ers, scientists and aides, studying
arrying out research in the fields
etallurgy, chemistry, ceramics, ad-
s, ablution materials, welding,
estructive inspection, insulation sys-
fuels, lubricants, thermal control
gs and many other fields.

s laboratory is a major facility
se many conventional materials
ot function in the severe environ-
of space and new materials or
sses must be developed to cope
the incredible extremes of space
Developments in these fields are
aving a marked effect on general
rial processes used for everyday
n earth. There are 51 professional
nel engaged in this laboratory and
pporting technicians with 24 gen-
ther personnel.

other laboratory, the Microelec-
s Laboratory, occupies 35,000
feet of space. It contains the
Film Research Laboratory, Pack-
Development Laboratory, Central
rt Laboratory. These all contri-
o making and testing of integrated
ts, and fabricating thin film cir-
This is a system of depositing a
ial in a thin film to make complex
onic circuits. Thin film circuits can
ade varying from a small fraction
inch up to five inches square.

ulation of conditions for space
nnel involves many factors, includ-
hysical stresses, weightlessness, and
space flight navigation and man-
ing.

special Multi-Stress Chamber ex-
test pilots and astronauts to five
es of rocket launches and re-entry.
are loud noise, vibrations, varia-
of barometric pressure, heat, and
minating gases. The reactions of
stronaut are measured and record-
hen there is a Space Chamber used
tudying life-support concepts. Here
ists learn the "astronomical facts of
or what is required to support life
ng space missions. In 1964 five
were sealed in the chamber for 30
while testing a life support system.

Multi-Stress Chamber has been
bed as a torture chamber. In the
used by the Boeing News Bureau
chamber confronts its subjects with
tremely tough physical and psycho-
l obstacle course. But man must
to hurdle the obstacles of loud
nerve shattering vibration, wide
ion of barometric pressure, chang-
mperatures, and exposure to dan-
s gases such as carbon dioxide, if
to ride through the dangerous
onment of space."

t subjects in the chamber can be
ed in either full space suits or pilot
alls, and equipped with sensors
measure temperature, respiration
eart rate. During "flight" the cabin
be filled with ear splitting rocket
, vibrated as it would be riding
ket booster through blast-off, and
ming the crew are suitably clad—
to 400 deg. F, or depressurised.
r all this strain, the astronauts
be asked to operate instruments
n piloting and navigating.

Space Chamber for these studies
feet long, 10 feet wide and 8 feet
It is an airtight double walled
Airlocks permit men to enter
eave the chamber without the out-

SIMULATION AIDS THE NAVY

Putting a nation's fleet to sea for training exercises is a fantastically expensive business, particularly as bad weather can render the whole exercise useless. Electronic simulation now makes it possible to provide realistic training at any time at a relatively small cost.

Hundreds of thousands of square miles of ocean and sky have been "compressed" electronically into a 40,000-square foot building in San Diego, California, to train America's hunters of hostile submarines. Designed by the Lockheed Electronics Company under a $7 million contract with the U.S. Navy, the new computer - controlled training system simulates the "real time" actions of an entire anti-submarine warfare task force including ships and aircraft.

It will provide shore-based training for classes of up to 250 Navy personnel with a degree of realism approaching actual sea manoeuvres, but with no danger of candidates getting seasick.

"The installation will permit the Navy to give realistic, co-ordinated tactics training to ASW Task Force crews without the expense of taking a fleet of ships and aircraft to sea," stated Daniel J. Gribbon, President of Lockheed Electronics Company.

Thirty-six individual rooms surrounding a central auditorium represent the command centres of the ships and aircraft that make up the simulated task force. Each is isolated from the others except for communications and sensing equipment—radar, sonar, electronic counter measures, etc.—normally found on the ship or aircraft it represents.

Eighteen of the command centres may function as destroyers or submarines and sixteen as fixed wing aircraft or helicopters. An aircraft-carrier and a flag plot are also included.

The central auditorium houses display screens plotting the action, five instructor consoles from which the exercise is controlled and a large digital-analog computer which is the "brain" of the entire system.

Crews in training do not work out "canned" problems with predetermined solutions. Instead, actual operating conditions are simulated to such a degree that instructors can manoeuvre "enemy" submarines at speeds and on courses like real submarines. Candidates then have to respond to the situation created as if really in action at sea.

On the local scene, the R.A.N. is planning for similar instructional facilities. It is to spend $17 million on training models of equipment to be used at sea. This represents the largest purchase of training equipment in the Navy's history.

The expenditure, authorised by Federal Cabinet several weeks ago, was announced by the Minister for the Navy, Mr F. C. Chaney.

Nearly $10 million is to be allocated to the two N.S.W. shore training establishments, H.M.A.S. Watson and H.M.A.S. Nirimba. More than $3 million will be spent on simulators of the Australian-designed Ikara anti-submarine missile system.

Most of the Ikara missile simulators, to be made in Australia, will be installed at H.M.A.S. Watson, which specialises in navigational and anti-submarine training. H.M.A.S. Nirimba, where 500 apprentices are under training, is at Quaker's Hill, near Sydney. It will get a vast array of electronic and engineering aids.

H.M.A.S. Cerberus, near Westernport in Victoria, a weapons, maintenance and radio and radar training establishment, will get about $7-million of new equipment, including the Ikara missile simulators.

Most of the equipment should be installed within the next 20 months. It will all be operational before the end of 1969.

The Australian developed Ikara missile on board the destroyer-escort H.M.A.S. Stuart in readiness for its first test firing. It was completely successful.

side air entering or the inside air escaping. In a major experiment the space chamber was fitted out to provide complete capability for life for five men for 30 days. The space resembled the quarters which would be available in a space ship on long missions. Apparatus in the chamber included a system to produce oxygen, and an apparatus for waste disposal and reclamation, which collected, processed and recovered water from body wastes, cabin condensation and sink drainings.

To simulate weightlessness a neutral buoyancy research facility is used. This tests subjects under water in standard space pressure suits specially adapted to attain conditions of zero gravity. The underwater studies provide important answers for engineers who design interior configurations of space vehicles to meet the needs of men who will operate them under the weightless conditions of space. The test chamber is a cylinder 20 feet deep, 25 feet in diameter, and holding 75,000 gallons of water.

Space pressure suits are double layer garments and, in true space use, the space between the outer and inner wall may be filled with gas under pressure, forcing the inner layer against the astronaut's body to control the effect of G forces, etc. At the same time the astronaut would be supplied with air or oxygen via his helmet.

To simulate weightlessness under water, the same suit is filled with water between the inner and outer layers, again forcing the inner layer against the wearer's body, but this time for the purpose of reducing the amount of air in the suit, between the inner layer and the wearer. In this way the amount of air may be reduced if necessary, to little more than that within the helmet or to any intermediate degree sary to produce neutral buoyancy.

The test chamber can be us assemble entire vehicles under under conditions of weightlessnes project scientists wearing suits a cribed. Simple tasks like turning a pulling a lever, waving an arm, fl through a hatch or making a angled turn become unfamiliar ex in the weightless environment of flight. This underwater experime provided valuable data for the of hatch configurations, tunnel crew transfers in space station body restraints necessary for men ing in space and the design and tools in maintenance operations.

For space flight simulation ther "Visual Space Flight Simulator which astronauts "fly" in spac means of closed circuit televisio computers. This simulated flight vides engineers with information ling them to design more efficier tems, and furnishes the astronaut the problems they will encounte must overcome in real space flight.

To train astronauts to rend with other space vehicles, and to at "space ports" and orbiting stati Rendezvous and Docking Simula provided. This also provides en ing data on manned systems p mance of both present and future vehicles. For example, the reaction to the vehicle's physical figuration and dynamic perfor can be evaluated, providing design meters which could not be obtai any other way.

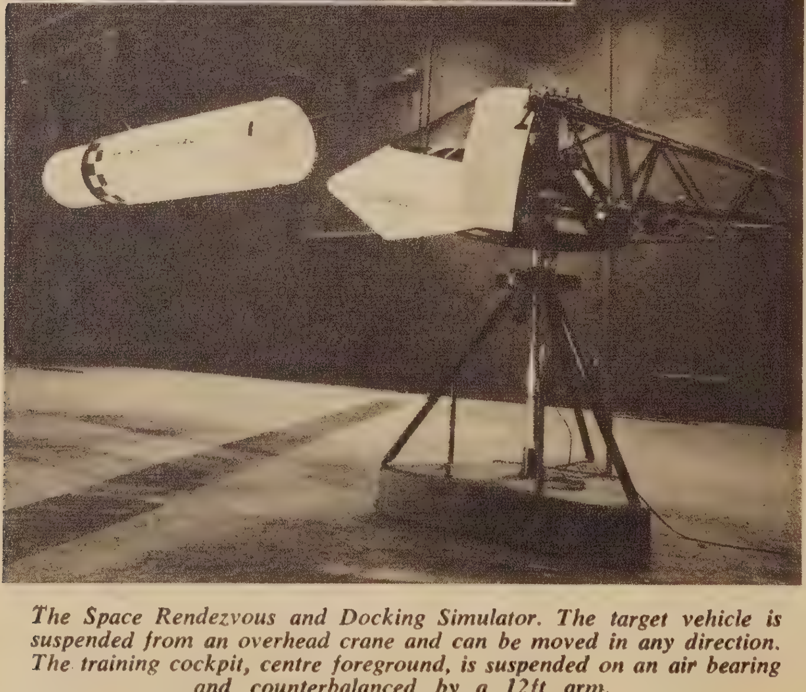
The Visual Space Flight Sim consists in its major parts of a spherical screen 30 feet in dia located in a special projection which is blacked out during sim space flights. The pilot's cock placed at the focus of the hemis in the centre of a tiny universe. T space scenes can be projected o screen by means of a computer trolled television system, models, star projector.

As the pilot operates cockpit co the scene changes in response t commands. Four different camera be operated simultaneously to p sequenced camera shots from c altitudes down to near su approaches. Space vehicles ca superimposed on the screen and n through a prescribed trajectory. plete star systems can be shown o screen by means of the star p tor. Another device generates electronically and projects them th the television system. More than identifiable stars can be repres over the celestial hemisphere.

Scale models of the earth, moo selected landing sites are located room near the projection room. C the model room, it measures 50 by 96 feet and has 90 foot t running down either side. Tele cameras are mounted on movable riages which ride on the tracks. I flat scale models of the earth lunar surface are used for clos pictures. Thus lunar landings, lunar offs, earth-atmosphere re-entries, landings, and orbital rendezvous inspection can be very effectively s lated.

As the space pilot moves co controls during simulated flight, mands are fed through a com system which tells a particular ca

Part of the model room, showing a globe of the world with a TV camera suspended above it. The camera moves in accordance with instructions from a computer, initiated by control commands from the astronaut.



The Space Rendezvous and Docking Simulator. The target vehicle is suspended from an overhead crane and can be moved in any direction. The training cockpit, centre foreground, is suspended on an air bearing and counterbalanced by a 12ft arm.

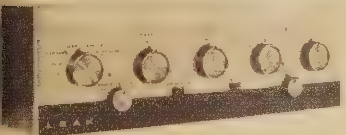
THIS FINE EQUIPMENT IS AVAILABLE AT ENCEL STEREO CENTRES . . . ASK FOR AN EMQ (ENCEL MAIL QUOTE) OR A TRADE-IN VALUATION. YOU'LL SAVE MORE AT AUSTRALIA'S GREATEST HI-FI CENTRE!

DFON E ARMS AND TRIDGES

90% of Australian professional users . . . and television stations and recording os . . . have standardised on ORTOFON ng coil pick-ups. The ORTOFON system is ently more linear and is consistently e and predictable . . . and as close to ; **free from distortion** as modern science make it. Stereo demands higher perform- standards . . . ORTOFON satisfies every ınd!

HEUS TRANSCRIPTION TURNTABLES

designed and precision engineered, the IEUS "Silex" turntable has many exclusive n features . . . belt drive, motor and ıp are isolated, rumble and wow are nated, 4 speeds with variable speed ol . . . and above all, the ORPHEUS is letely **silent**. Feature for feature, the EUS "Silex" offers greater value.

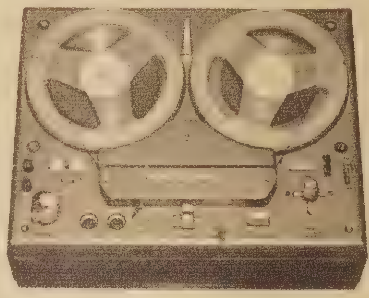


AMPLIFIERS

the release of the first LEAK "Point One" s amplifier in 1945, constant development esulted in universal professional accept- of LEAK amplifiers and speaker systems. ıunications laboratories use and specify equipment . . . so, too, do radio and sion stations and recording studios. stic high fidelity systems manufactured e LEAK organization are the best invest- for the discriminating music lover. Solid (transistorised) and valve types are avail- with power ratings up to 60 watts R.M.S.

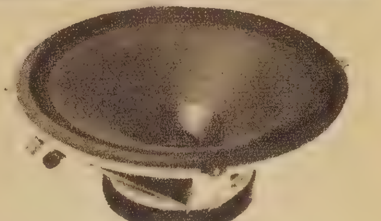
SANSUI integrated stereo tuner/amplifier

Sansui's trend setting styling blends with any decor . . . it is both dignified and modern. The Model 220 incorporates AM/FM/SW tuners and has a total output of 22 watts . . . frequency response is 35-20,000 Hz plus or minus only 2 db.



TANDBERG TAPE RECORDERS

Wherever the demand is for precision, reliability and natural sound reproduction, the choice must be TANDBERG. TANDBERG recorders simply reproduce the original performance . . . nothing is added and nothing removed. Illustrated is the new TANDBERG "Series 12" . . . a **complete high fidelity stereo system**. Now solid state, the "Series 12" incorporates twin ten watt RMS stereo amplifiers . . . if you add external speaker systems and a turntable/pick-up combination you have one of the finest stereo systems available in Australia today. This remarkable recorder may also be used for language study applications. Without reservation it may be claimed that the TANDBERG "Series 12" is the most versatile and advanced stereo tape recorder on the market.



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LEAK SANDWICH SPEAKER SYSTEMS

Ever-increasing demand and consequent greater production in the new Australian LEAK plant have reduced the price of the renowned LEAK Sandwich Speaker System. Although the overall frequency response extends from less than 30 Hz to over 20,000 Hz, between 50 Hz and 15,000 Hz the response is substantially linear, varying only plus or minus 2 db.

◀ THE NEW HAMMOND M100 CONDENSER MICROPHONE

Designed for use in recording studios as well as by the recording enthusiast, the superb M100 is available in mono and stereo versions. Low source impedance permits use of long extension cables. Frequency response is 30 Hz to 20 kHz, plus or minus 1 db. Size of microphone — 4" x ⅞" diameter. Supplied with transistorised stabilised mains-operated power unit, Encel price is remarkably low for such high quality. See the review in "Tape Recorder", Feb., 1966.

Encel Price: Stereo $118, Mono $74 (with power supply).

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	Simple Oscilloscope Measurements	0.50	0.04
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ɔw to approach the target (either an rth or lunar landing area), shifting e scene on the screen in the adjoin- g room. So far as the pilot can tell is moving in toward a landing be- use he sees nothing but the scene anging in front of him in response to s commands.

The changing images give the astro- uts in the stationary cockpit a sense flight. The spaceship actually appears be moving, as the images of the oon's surface or landscape change on e screen. The image tilts on the reen and pilot senses that his craft tilting. He moves the controls in the ckpit and the craft is restored to even keel, as the image returns to even position.

A stark and brilliant light from the n is seen in outer space. This is nulated in the model room by a syn- etic sun consisting of 400 individual hts in a metal honeycomb to pro- ce collimated light in almost parallel ys. Light of this nature produces arp shadows on a simulated lunar rface almost exactly like those an tronaut would see if coming in for landing.

As the Boeing News Bureau puts it, he Boeing Space Flight Simulator has en developed to provide a research ɔl for investigating the performance man in carrying out space-flight ssions. The primary objective is to ce the man in a highly realistic nsory environment, and to provide e visual, auditory or other cues re- ired to give him the sensation of tually conducting a space-flight mis- n. The analysis of man's performance . . provides design data used to nfigure new space craft. A secondary jective is to provide a training facility demonstrate handling techniques and ner pilot tasks prior to an actual ace flight."

The other major space flight simula- n facility is the Rendezvous and ɔcking Simulator. Occupying 15,000 uare feet of floor space, 70 feet high, d 240 square feet of computer room, is used to provide engineering data space vehicle docking and inspection manoeuvres. The target spacecraft suspended from an overhead crane ich moves back and forth the length the room. The crane is geared to ɔve at 10 feet per second and can rt, stop or change direction almost mediately.

The pilot sits in a cockpit — repres- ting the chase craft — which is ɔunted on the front end of a 12-foot- g frame suspended on an air bearing. cking motion, swivelling to right or t, and a 45 degree angle roll can be en to it by means of small reaction s mounted on the frame. The attitude the cockpit and the movement of the get vehicle are controlled from the ckpit and all commands pass through computer system which co-ordinates joint action of cockpit and target.

In the Visual Space Flight Simulator illusion of movement is brought ɔut by changes of scene on a screen. the case of the Rendezvous and cking Simulator, the cockpit makes nor changes in attitude as the frame rotated but most of the major move- nts are made by the target. However, the pilot, it appears that the cockpit moving through space as he noeuvres to complete a simulated ce docking mission.

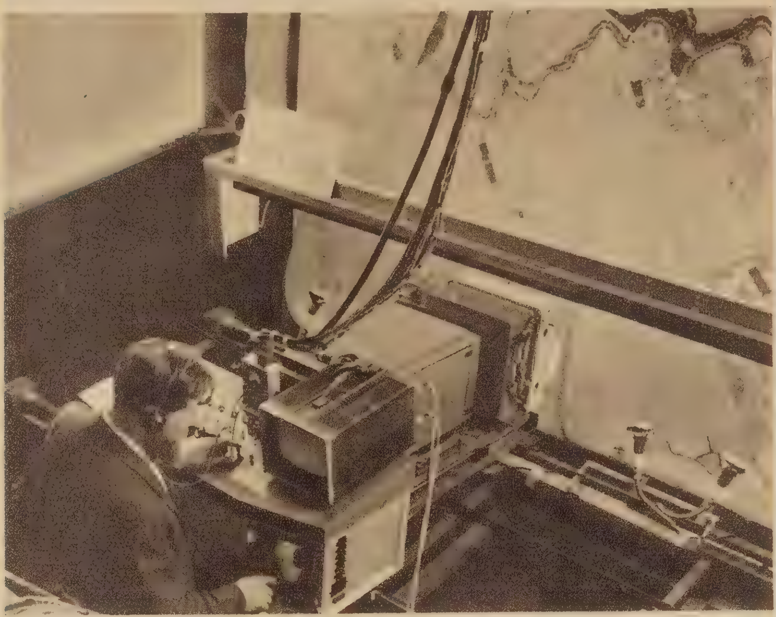
The cockpit of this simulator has a removable shell for quick configuration changes and easy interior access.

The space docking simulator facility provides unlimited yaw motion and plus or minus 45 degree of pitch and roll motion. These limits allow simulation of the majority of attitude control problems associated with space docking which is THE all important aspect of a lunar landing.

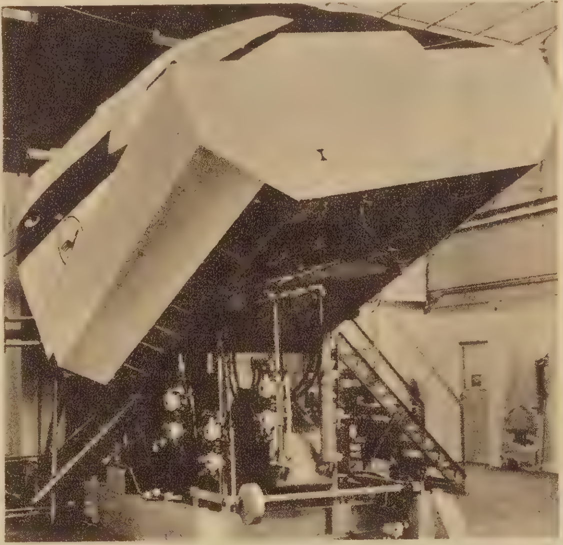
The importance of computers to vast projects such as these is illustrated by the fact that the Boeing Company have, in Seattle, 28 IBM systems, employing 400 programmers, 75 systems engineers, 120 computer operators, and 160 other personnel. From this it is evident that, regardless of what views one might hold regarding the value of space research, the program has penetrated deeply into industry and become a vital factor in its economy.

I am indebted to the Boeing News Bureau and IBM for their co-operation in making available much of the information and the photographs used in this article. ▬

SIMULATION AIDS AVIATION



This Colour Visual Flight Attachment will be used for research on the Anglo-French Concorde supersonic airliner. A TV colour camera scans a model of terrain from the position of a Concorde pilot. The colour picture is projected on a screen in front of Concorde flight simulator screen. The model terrain represents an area around Toulouse airport and is on a scale of 1:2000. The system was made by General Precision Systems Ltd., England.



The "works" of a typical cockpit simulator. This is a Boeing 727 cockpit which can be moved in three axes by means of the hydraulic cylinders visible beneath it. All movements are computer initiated in response to the pilot's adjustment of the controls in the cockpit. Likewise, all instruments on the panel respond exactly as in flight.

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Versatile Computer Print-out System

By Ian Brotherton*

The complete printer, showing printed forms emerging in sheet form. The paper travels at 40ft per minute.

While computers, in themselves, work at fantastic speeds, their effective speed as far as the individual user is concerned is governed largely by the speed of the print-out mechanism. Photography and xerography are combined in this design to provide a rapid and versatile print-out system.

In the large data processing installa- ns which are being planned and are ming into operation at the present ne, it is becoming increasingly portant to examine the overall system juirement, from the initial collection data to the final dispatch to the ulti- ate user of processed information.

Many data processing managers today cept the limitations of mechanical nters, with their restrictions on out- t speed and form layout, and are un- are of newer and more advanced out- t printing systems becoming available.

One of the most interesting of these tems, which is now being used in United Kingdom, France and Ger- ny, is the Xeronic High Speed Com- ter Printer, developed and marketed by The Rank Organisation Ltd., Data Systems Division.

In 1958 a small group of English engineers working in London became dissatisfied with the mechanical line printers which were available at the time, and decided that there was a need for a fast non-mechanical printer which could print the output from a computer at about 3,000 lines per minute.

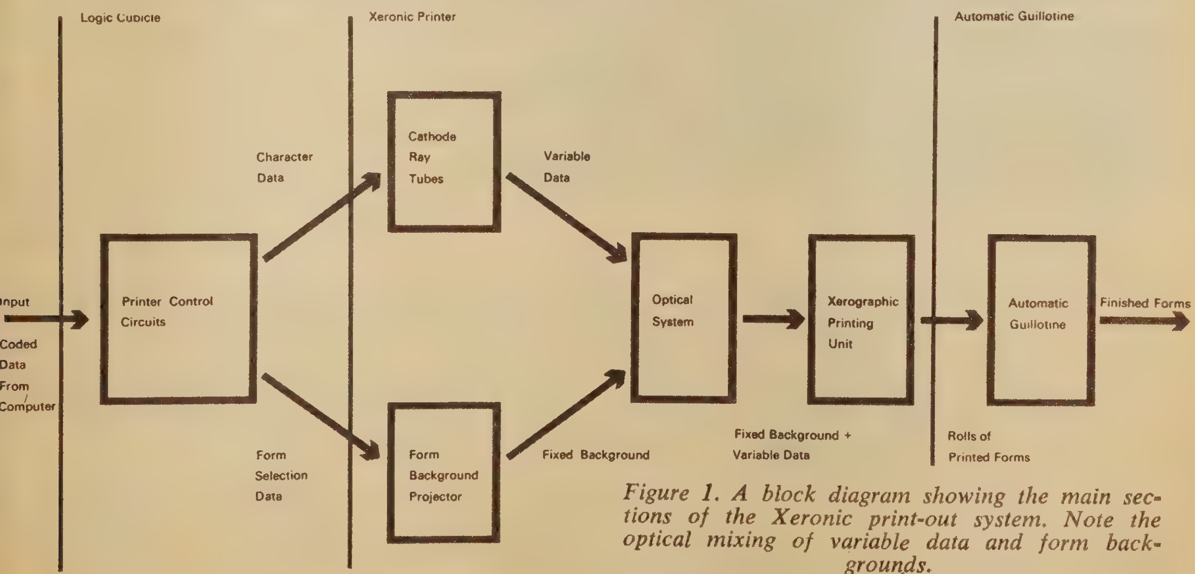
These engineers, working in one of the laboratories of the Rank Organisation, developed a laboratory model of a xerographic computer printer during 1958. This created such interest at the first London Computer Exhibition in the autumn of that year that the equipment was put into production, the first deliveries being made in 1961.

During 1962, it was realised that to be competitive into the late sixties, a more advanced machine would be required and the Series II Xeronic Printer was designed and built, with the first deliveries being made at the end of 1963.

Xeronic printers are today working at a variety of U.K. Government installations, including the Royal Air Force and Ministry of Pensions and National Insurance, and industrial concerns including the Commercial Union Assurance Company Limited and Messrs J. Lyons and Company Limited.

In Europe they have been installed at the Compagnie D'Assurances Generales in Paris, at Mutuelle Generale Francaise in Le Mans, at Zusatzversorgungskasse in Wiesbaden, and an installation will shortly be made for the Danish Government in Copenhagen.

The Xeronic printer is normally used in an "off-line" installation, reading magnetic tape prepared by the computer on it own magnetic tape transport. The signals from this tape are read, a block at a time, into the printer's own ferrite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Printer Control Circuits
Optical System
Xerographic Printing Unit
Automatic Guillotine
Finished Forms
Form Selection Data
Form Background Projector
Fixed Background
Fixed Background + Variable Data
Rolls of Printed Forms

Figure 1. A block diagram showing the main sections of the Xeronic print-out system. Note the optical mixing of variable data and form backgrounds.

***Managing Director, Data Systems Division of the Rank Organisation.**

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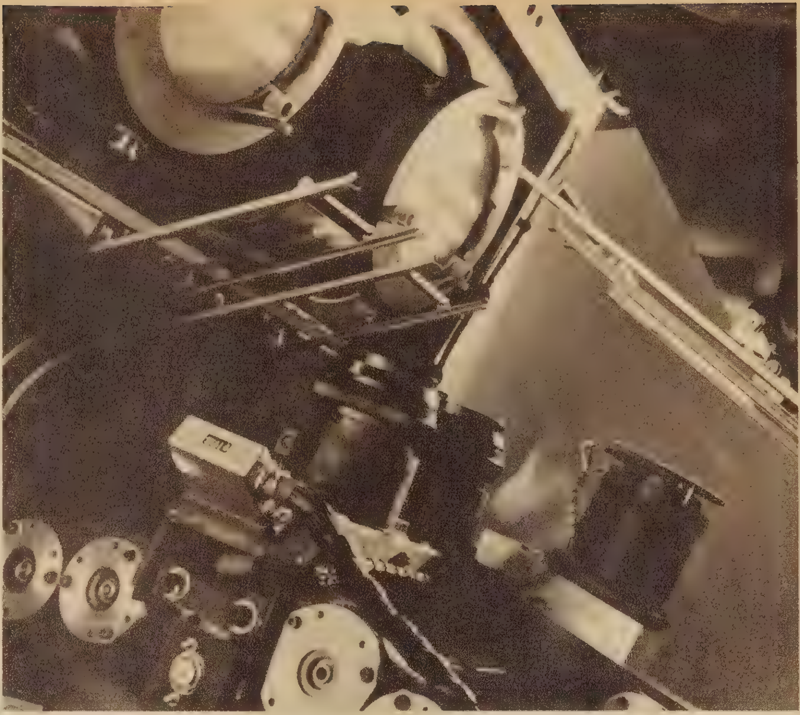

A photograph inside the formhead (see diagram below) showing CRT faces, projection lenses, microfilm guides and transport rollers.

memory. These signals consist of printable data together with com- ds which have been inserted at opriate places by the print edit pro- n in the computer.

he stored signals in the core memory decoded as printable characters, or mands, the former being displayed characters on the faces of cathode tubes, and the latter being used to rol the various functions of the ter, including addressing the infor- ion to the correct areas on the out- documents.

he printer also includes a micro- strip containing the outline forms p to 32 different documents which be selected in any order by signals the magnetic tape. The light output n the cathode ray tubes and a film ector are combined and printed by process of xerography on to a roll of p, plain, uncoated paper, at a print- speed of up to 7,000 characters per nd, giving documents up to 2ft wide steady speed of 40ft per minute. high speed is a direct result of the plete absence of any fast-moving hanical parts.

special papers are required, for nple, with security microprint or pre- ted information on the back or front the documents, or glue strips for ls, the Xeronic printer has means reby the cathode ray tube and form ting facilities can be brought into registration with the pre-printed rmation.

he output from the printer is in the n of a roll which can be perforated edge trimmed and then placed on a ial cutter, provided with the equip- t, which produces the final docu- t in the form the user requires. This er can in turn be linked with other r handling equipment such as folding envelope filling machines. Figure 1 vs the basic arrangement of the onic system.

igure 2 shows a diagram of the ter mechanism. The light transmit- the variable information from the ode ray tubes passes through lenses is reflected by mirrors, coming to a s on the surface of the xerographic nium drum.

t the same time light from a pro- or lamp passes through the film, held film guides, in the formhead, and r passing through a lens and being cted from two mirrors also focuses o the selenium drum. The formhead hanism enables the correct form ground to be selected in accordance the computer's instructions.

he lower half of the printer contains paper transport system and the xero- hic selenium drum, with its charging, loping, and cleaning mechanism. xerographic equipment is based on Copyflo design and is made under ice from Rank Xerox Limited by the a Systems Division.

milar xerographic machines are made copying purposes and are marketed Rank Xerox (Australia) Pty. Limited. For other articles on xerography see ECTRONICS Australia" for March September, 1966.)

he selenium drum is housed in ght tight container and rotates at a dy speed. The surface of the selen- is uniformly charged by a device wn as a "scorotron" and will retain charge until exposed to light.

s the drum rotates it is exposed to the light images from the cathode ray tubes and the film. Where this light falls the charge on the selenium surface will leak away, and a latent image will remain on the surface of the drum. The drum is then cascaded with a thermoplastic printing powder which is electrically charged in such a way that it will be attracted to those areas of the drum which have been exposed to light, and will be repelled from the unexposed areas.

At the bottom of the printer, paper from a roll is brought into contact with

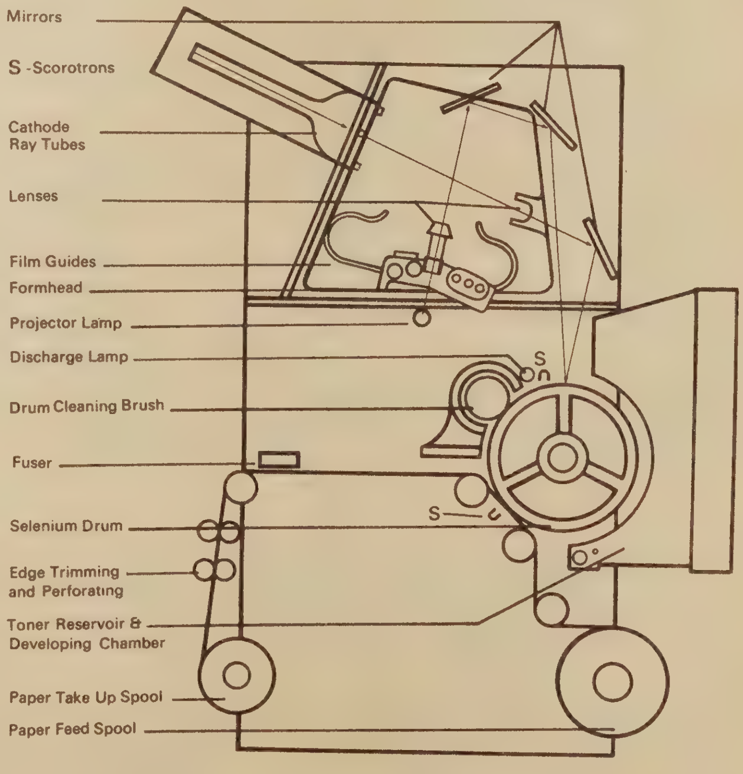

Figure 2. A line drawing of the complete system, showing how the CRT and microfilm images are combined optically on the printing drum.

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The KIKUSUI 539 is a simply operated oscilloscope designed for compactness and portability. I uses a 3" cathode ray tube while printed circuits and rugged construction ensure reliability and ease o service.

The vertical amplifier is stable with good characteristics; it uses a wide band push-pull circuit The horizontal amplifier has a wide continuously variable sweep.

The 539 is provided with a convenient time base oscillator having a sweep covering 10c/s t 100Kc/s in steps with continuous variation between.

SPECIFICATIONS

Y AMPLIFIER:	Sensitivity:	Better than 1 Volt p-p/cm at 1 Kc/s
	Response:	5c/s to 1Mc/s within -3db
	Attenuator: (Frequency Compensated	Steps: unity, .1 and .02 continuously variable)
	Input Z:	1 megohm shunted by 20pF max.
X AMPLIFIER:	Sensitivity:	Better than 3V p-p/cm at 1Kc/s
	Response:	1.5c/s to 400Kc/s within -3db
	Input Z:	2.2 megohms approx shunted by 60pF max.
TIME BASE:	Sweep Freq.:	10-100c/s: 100c/s-1Kc/s: 1Kc/s-10Kc/s: 10Kc/s-100Kc/s (Continuously variable between steps)
SYNC:	Internal +, —, Line, External	
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drum and a further electrostatic pro· transfers the printing powder off the n surface on to the paper. The paper passes underneath a heater (fuser) h fuses the powder into the surface he paper, giving a permanent print nigh quality. In the meantime the inuously rotating drum is cleaned recharged.

ne printer system includes a mag- tape machine, compatible with e used in the computer installation, h accepts a magnetic print tape en by the computer. The recorded will be in a 7, 8, or 9 bit code, iding the normal computer parity ks. The data will include printable acters, commands to the printer, y checks and, if necessary, block tification details, or control instruc- s for the tape unit.

ne packing density and character fre- cy will vary from installation to llation. A typical density would be characters to the inch on the mag- tape, with a character frequency 1.7KHz.

he information from the tape hine is transferred, a block at a time, ugh the input circuitry into the core e. The capacity of a standard onic printer's store is 1024 arrays the usual maximum block length is arrays, which allows writing into reading from the store simulta- usly.

s the magnetic tape signals are read the store, tape parity checks are ied and checks are also made on completed block. The tape control res that the tape machine is started stopped at the correct times to re that checked information is always ne store ready for use by the printer.

ne arrays in the core store are de- d, one at a time, by the decoder, are recognised either as printable acters or commands. In the case characters, signals are sent to a acter generator, which can give r 50 or 96 different characters, nding on the specification. These acters consist of dot patterns, each acter containing up to 32 dots in case of the standard size characters, 2 dots in the case of special large acters.

is found that in conjunction with xerographic printing process, this ber of dots is sufficient to give a l quality character with continuous nes. Characters can easily be ged by replacing circuit boards, and quality is adequate for optical acter recognition with the majority xisting systems.

ne commands include horizontal and cal addressing of information, and positioning of the film strip to pro- the correct form outline. Also, two cathode ray tubes are pro- d, one for printing on the left-hand and one for printing on the right- l side of the paper, facilities are ided for either making copies on the and right-hand sides, or for suppress- either tube so that differing informa- can be printed on the left and -hand sides of the paper.

ne character spacing on the paper 10 characters to the inch, to enable print to be read by optical character gnition equipment, and up to 228 mns of print can be used.

here is a facility which permits a plete form to be reprinted up to n times without the necessity of repeating it on the magnetic input tape, provided that the form to be repeated does not occupy more than one block of data on the input magnetic tape. It is brought into operation by a command on the input tape associated with the data to be repeated. The command inhibits the normal operation of the core store, so that while the form to be repeated is being printed it contains only the data for that form. The command consists of the "repeat" code followed by a binary number indicating the number of repeats wanted. A switch can also be provided to cause repetition to continue indefinitely.

A 35mm microfilm camera can be fitted to operate in synchronism with the printer and record the printed output, one camera loading covering a complete roll of paper.

Records produced in this way take up very little space, they require the minimum of handling for reproduction and are cheap and readily accessible. They are ideal as a master file standby and for archival use, since they permit the speedy reproduction of a complete document in the form in which it was originally issued. ■

PACKAGED BACKGROUND MUSIC

A self-contained on-location background music system which plays 700 musical selections and is designed primarily for small business, commercial, industrial and entertainment locations, has been introduced by the 3M Company.

The unit, called the 3M Brand "Cantata" 700 Background Music System, offers both equipment and music for outright purchase without the monthly rental charges common to other background music systems. According to the company, this basic concept is expected to broaden the use of background music, by making it available to small locations that previously could not afford a leased service.

Playing music from its own sound tape library of 700 musical selections, the 3M "Cantata" does not depend upon a central studio and does not require external phone lines or complex antenna systems.

It can be used as a self-contained system or with up to 32 additional speakers without added amplification. The unit is compatible with any existing sound system and can be used with a wide range of accessory amplifiers, microphones, and speaker systems, to cover virtually any location.

The complete background music system is housed in a case little larger than a conventional tape recorder.

Two unique libraries of scientifically programmed background music are being offered with the system. Each library contains 700 musical selections, which play continuously or intermittently as determined by the user. Specially recorded by 3M, the libraries are built around the great musical standards and create an atmosphere in retail stores, restaurants, hotels, factories, business and professional offices, reception rooms, and similar locations.

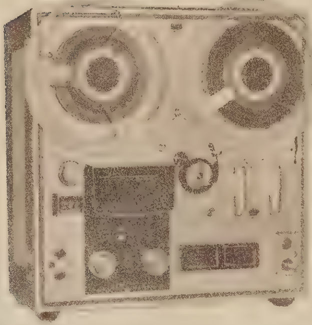
The system—tape transport, amplifier and controls—is housed in an attractive walnut case measuring 15 inches by 7 inches by 12 inches and no larger than an average tape recorder. Operation is automatic and requires no threading, re-winding or tape handling. Controls include on and off buttons and a combination volume and tone control. Microphone input and external speaker output jacks are provided on the rear panel. A timing device provides intermittent operation if desired.

The compact size and capacity of the music libraries is based on recent developments in magnetic recording tape technology. They are stored on quarter-inch wide low-noise tape which plays continuously at 1 7-8in/sec from one of four monaural sound tracks.

In Australia, the system will be handled by Minnesota Mining and Manufacturing (Australia) Pty. Ltd. ■

Whether you buy this

this



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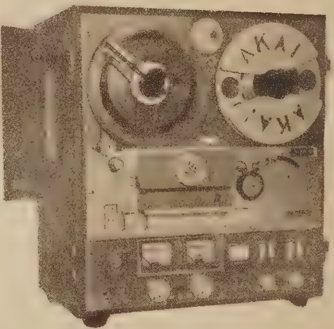

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AUSTRALIA'S LARGEST RADIOTELEPHONE SYSTEM

In the terms of a $1 million contract, Standard Telephones and Cables will build and operate Australia's largest private telecommunication system to develop the iron ore fields, 1,000 miles north of Perth in Western Australia. The new system will link the mining town of Mount Tom Price to the deep sea port of King Bay, 180 miles away.

t is from King Bay that the world's ;est bulk ore ships will load iron ore Japan and European countries. Work the new mining complex was begun than 18 months ago by Hamersley ı Pty. Ltd., which also built the port. ; railway line has been completed and ady regular shipments of iron ore e been made from the port to over- ; countries.

'he radiotelephone system which .C. will build and maintain for 10 rs under the contract between the two ıpanies, involves two terminal and repeater stations. It will supply 12 'otelephone and telegraph channels be- en the two townships and can be ex- led to 24 to meet future requirements.

: will also provide continuous com- ıications between train movement of- rs and train crews over every yard of and enable crews to be warned im- liately of obstructions or floods.

Iount Tom Price and King Bay now e populations in excess of 500 which substantially increase in the near ıre.

'he automatic telephone exchanges in ı township will be joined for single- : operation by the 12-channel radio- phone system. This will enable a y in one township to call someone the other, without operator interven- , by simply dialling four digits (local s require three).

'he system includes special "hot lines" executive use and channels for tele- ms, telex or electronic data proces- ;. Two telephone channels are also ıg made available to the Postmaster- ıeral's Department for termination the Post Office.

'he radio system will accommodate such 12-channel systems, so that a ›nd set of channels can be added to vide 24 direct "lines" between the two nships.

'he system is designed so that only operator is needed to serve both ex- nges; the operator will be located at g Bay. At this coastal township the em has access to the P.M.G. national vork via another radio link to Roe- rne, 30 miles north-east.

'o haul the ore from the Mount Tom e mining area to the deep sea port uired the building of one of the ld's heaviest duty railroads. Of stan- l gauge and capable of accommodat- a train carrying 18,200 tons of ore 5 m.p.h., its route is through desolate itory ranging from near sea level to)0ft at Mount Tom Price. Its isola- , together with the type of operation, ıires a unique mobile radiotelephone em.

. train of 180 ore cars is over a mile ength and is hauled by three diesel ›motives, each developing 2,750 h.p. king must begin five miles before reaching the King Bay end of the line.

Track maintenance is a continuing effort which must give way to the mainline operations. Safety and efficiency requires a highly-disciplined traffic control, which means that communications can be provided only by radio.

The radio system must operate on frequencies which are not influenced by the weather and daylight to darkness cycles. VHF or UHF provide the necessary stability but their range is limited.

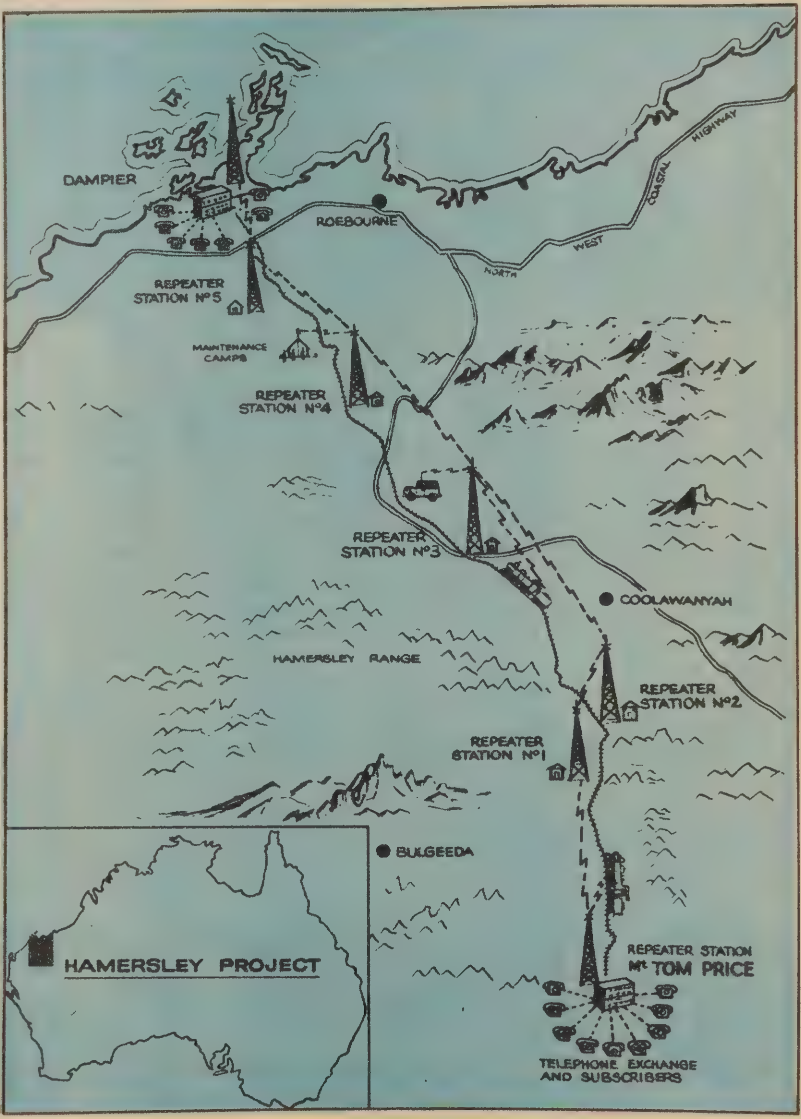
This limitation has necessitated a system design based on "talk-through" repeater techniques and the linking together of a chain of repeater stations into a system in which every station repeats all signals received at one or more stations along the 180-mile chain.

The S.T.C. system will enable the driver of a locomotive to call and talk to the driver of another locomotive, a highway motor vehicle or a wayside maintenance camp or to the dispatcher or train controller at either end of the line.

Maintenance crews will be able to warn train crews along the whole of the line of washouts, damaged tracks, etc. The train controller at the King Bay end may assume control of all communications along the right-of-way.

Combining the 24 - channel point-to-point radiotelephone relay system with the mobile train system created special problems, such as the need for some relay stations spaced only 13.5 miles apart, instead of the usual 30-mile spacing. This close spacing will enable signals to penetrate into deep gorges and cuttings in one section where the rail line follows a winding pass through the

(Continued on page 189)



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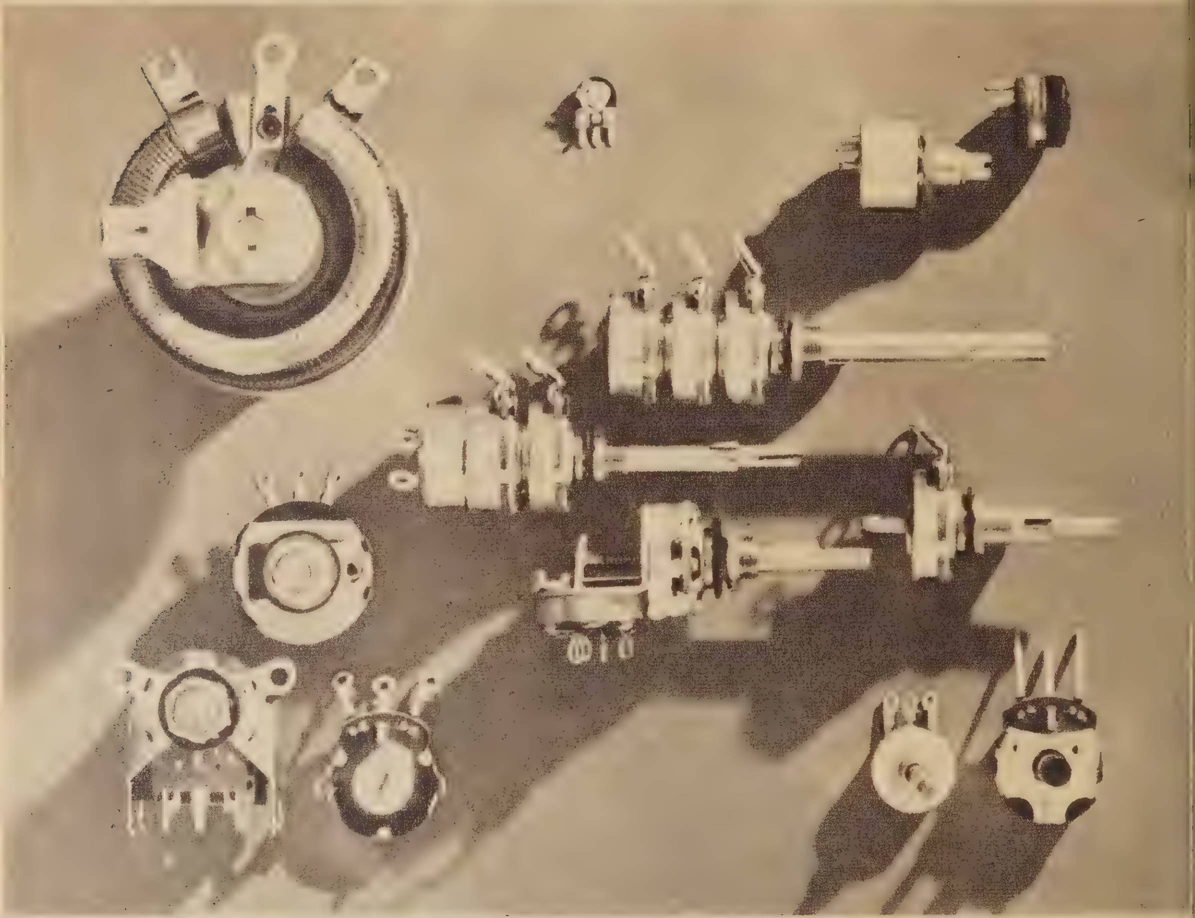

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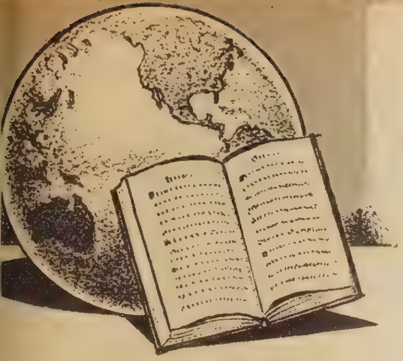


Technical Review

LOW-LIGHT TV TURNS NIGHT INTO DAY

One of the major difficulties of Allied forces in the jungles of Vietnam is that the Vietcong strikes at night and escapes under cover of darkness. Reports from Vietnam now tell of U.S. Army helicopters equipped with low-light-level television cameras that allow the searching forces to detect the enemy by moonlight or starlight.

By Marvin Reid

According to the "New York Times" d "Washington Star," there are five the new TV systems, code-named atman," in South Vietnam. One of em recently picked up a good picture 2 a.m. of a couple of enemy trucks d the unloading of a Vietcong sam- n. The systems, each of which cost JS1 million, consist of a small TV mera mounted on the nose of the heli- pter and two 8in TV receivers. One eiver is in front of the co-pilot and other is in the rear for use by a oto interpreter. The view can also be leo-taped. Although both the Air rce and the Navy are interested, the tman systems are being flown by the my.

The reports did not say who built tman equipment and the Night Vision boratory of the Army Electronics mmand at Fort Belvoir, Va., where h work is being done, or contracted , won't even discuss it.

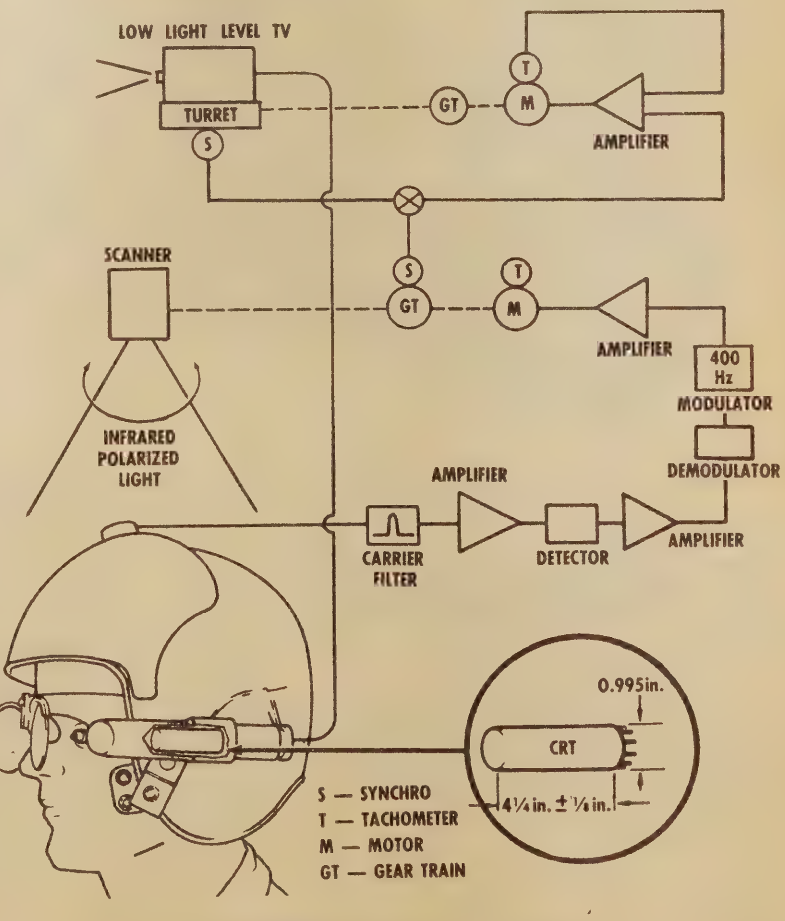
One of the more interesting projects, rtially sponsored by the laboratory, known to be a low-light-level TV tem being built in Hurst, Texas, by Bell Helicopter Co., a division of l Aerospace Corp. The TV camera, ich is installed in a three-axis turret the nose of a UH-1B helicopter, is ned by the movement of the pilot's ad—up, down, left or right. The ot's display screen is a special pair eyeglasses. He can also look through display on the eyeglasses at the ht scene as he would normally see it.

rojecting the display on the eye- sses eliminates the need to tie up uable instrument panel space for a ventional display system and it gives pilot a natural view of the direction which he is looking.

Miniaturised cathode-ray tubes, built Bell by Thomas Electronics Inc., of saic, N.J., are on either side of the ot's helmet. Each tube is 1in in meter and projects a 1-mil electron t beam. With an aspect ratio of 3:4, image resolution is approximately 450 horizontal TV lines. Glasses and tubes weigh 15oz. The optics system, built by the Perkin-Elmer Corp., provides a 40-degree by 40-degree field of view.

The image on the face of the CRT is reflected by a mirror through a relay lens that reforms the rays into an aerial image. A second mirror positions the aerial image on the reflecting lens (the inside of the pilot's glasses), which also acts as a collimator. The result is that the TV image is superimposed upon the pilot's normal field of view.

The pilot's ability to aim the camera by moving his head is accomplished through an optoelectronic servosystem. It begins with a monitor attached to the top of the cockpit that measures the position of the pilot's head. The transmitter emits a cone-shaped (70-degree



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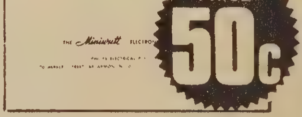

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38.27

beam of non-visible light in the near-infrared region, approximately 0.9 microns. The energy is 50 milliwatts.

The emitter is a gallium-arsenide diode, made by Texas Instruments Incorporated, that is excited at carrier frequencies from 3 to 10KHz. A different carrier frequency is used for each of the three axes—pitch, roll and yaw—to reduce crosstalk. The light passes through a linear polariser, producing a reference polarising angle. The polariser is mounted on a torsional scanner that operates on a frequency of 10KHz and modulates the carrier signal.

A second polariser is over the electro-optical receiver on the helmet. The receiver's output is also modulated by a 100Hz signal. The amplitude and phase of the modulated signal varies according to the angle and distance between the transmitter and the receiver. Its amplitude is inversely proportional to the square of the distance, and its phase varies according to the angle because of the polarisation of the infrared light.

The received carrier signal is filtered to reject spurious signals, for example, when pitch is being measured the carrier frequency for roll and yaw will be rejected. The output's DC level is detected and is used to develop an automatic gain control signal in the servo loop illustrated in the diagram on page 31 so that the servo loop gain is independent of the distance between the transmitter and the receiver.

Meanwhile, a phase - sensitive demodulator develops an error signal that drives a 400Hz modulator, amplifier and servomotor. The servomotor moves the reference polariser in the scanner to minimise the intensity of the light, thus nulling the error signal. A synchro control transmitter measures the servo position, which is proportional to head position.

The scanner system was fabricated by the American Time Products Co. at Woodside, New York. The filters were provided by the Polaroid Corp.

The only attachment to the pilot's helmet is a small flexible set of wires leading to the receiver. This connection can be quickly severed in an emergency.

The forerunner of this electro-optical system was a mechanical headtracker that Bell tested as a possible way to use the pilot's head motions to aim a TV camera. The mechanical system consists of a set of parallelogram linkages and gimbals with associated synchros to measure head position in pitch, roll and azimuth. It was fabricated initially to permit flight testing of the entire system.

All the systems except the low-light-level TV camera have been completed and tested in the laboratory. The tests were carried out with a regular TV camera. Flight tests have been conducted using the mechanical headtracker eyeglasses and the daylight camera, and Bell says the system feasibility has been confirmed.

The eyeglass display is being worked on now by Perkin-Elmer to improve the optical resolution. Also, the miniaturised CRTs are under further development to improve brightness and resolution. Both the mechanical and the electro-optical headtrackers are being reviewed critically. Future systems will be committed to one or the other headtracker design. Bell leans at this stage to the electro-optical, saying it provides the pilot with more freedom. But, the final decision on which system wins out will have to be made by the customer.

Editorial Note: The foregoing report was extracted from "Electronics" Vol. 39, No. 18. Similar in conception to the TV system of the "Batman" device but related to the more pacific needs of industry is a TV viewing system for use with remote-control manipulators, described in "Electronics," Vol. 39, No. 5.

The TV viewing system, which allows the viewer to change his perspective with respect to the object being manipulated, simply with a natural movement of the head, has been developed by the National Argonne Laboratory.

The system is composed of a TV camera and monitor that are slaved to a lightweight headpiece worn by the operator. When the operator moves his head, the camera and monitor follow suit. If, for instance, he moves his head to the left to gain a new perspective, the camera pans to the left; at the same time, the viewing screen moves to the left and remains in front of the operator's eyes. Technicians testing it were able to perform tasks satisfactorily after an hour of practice.

The system is designed to improve the way scientists and technicians can watch their work in areas inaccessible to them, such as in a radio-active chamber. Other devices still under development by Argonne will allow the operator to zoom in for a closeup of his work by moving his head toward the monitor.

Ray Goertz, director of the Remote Control Engineering division at Argonne, says the objective now is "to make it work pretty much the way your own head and eyes do."

Originally, the system was designed so that the monitor and camera closely and accurately followed the motions of the operator's head. But small inadvertent head motions produced annoying effects. These were eliminated by creating a slight "dead zone" in which the operators' head could move without causing a movement of the camera or monitor.

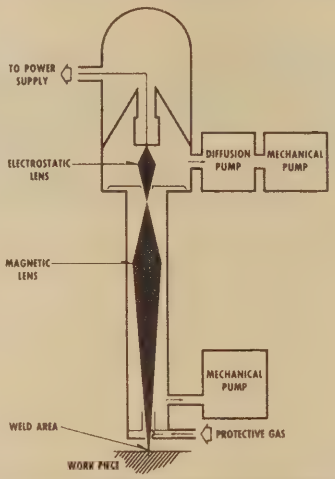
ELECTRON BEAM WELDING WITHOUT VACUUM

A tiny but powerful beam of electrons may play an important role, in the future, in landing American astronauts on the moon.

An electron beam welder, developed by Westinghouse Electric Corporation, is being produced for the National Aeronautics and Space Administration to make high quality joints without enclosing the workpiece in a vacuum. In addition, the new device has been designed so that the electron beam welding head can be brought to the work under the welder. This portability permits the unit to be considered for welds on the huge first stage of the Apollo-Saturn V space vehicle that will send the three-man Apollo spacecraft on its journey to the moon and back.

Electron beam welding uses a minimum of heat to produce a joint. Such joints match, very closely, the strength of the highly efficient materials being introduced into today's welded products. Efficient welds mean lighter structures and greater payloads.

The problem up to now has been that electron beam welding had to be done in a chamber evacuated below one-millionth of an atmosphere. This restriction severely limited the process and has restricted its use to portions of the structure which could fit in a vacuum chamber.



Under contact with NASA's Marshall Space Flight Centre, Huntsville, Ala., engineers at the Westinghouse Astronuclear Laboratory and the Westinghouse Research Laboratories are optimising the welding technique and have built a production model of the portable Westinghouse non-vacuum electron beam welder. Successful operation of the Marshall unit will clear the way for accomplishing the critical joining involved in Saturn V construction and on many other large structures on a production basis.

In the new welder, an extremely powerful beam of electrons is ejected into the air through a specially designed orifice system and then shielded from air with a cloak of lightweight helium molecules to do its work at atmospheric pressure. In peak operation, more than 15×10^{17} electrons per second are projected into the weld area to join the metal pieces. The welder to be delivered to NASA will handle some 13,000W of power at 150,000 volts.

The electrons for the welder's beam are emitted from a rugged, long-life, electrically heated tungsten rod. Under partial vacuum at their source, they are accelerated and focused by a combination of electric and magnetic lenses.

As the electron beam passes into the open atmosphere, helium gas flows around the beam to prevent heavier air molecules from dissipating the beam's energy. Also the helium, being inert, prevents oxidation of the workpiece.

The NASA welder will be capable of joining metals up to one-half inch thick, will be designed to operate under a wide range of power levels, and will have built-in flexibility of operation. These qualities are of value in applying the electron beam welding technique under field conditions. ("International Electronics," July, 1966.)

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WEATHER SATELLITE AVAILABLE TO AMATEUR FORECASTERS

Universities, schools and ambitious amateurs are now able to share with regular weather services the benefits of the U.S.A.'s ESSA 11 weather satellite.

Costs of simplified equipment for receiving the satellite's pictures have been cut to under $7,500. It could be homemade for considerably less. This contrasts with costs of $20,000 to over $42,000 for full scale ground equipment for regular weather stations.

The biggest single cost of a simplified ground station is the facsimile recorder. Beyond this, receivers of varying price and quality and aerials as simple as a TV aerial modified for tracking are adequate.

This sharp lowering of costs for adequate, if not fully professional, ground equipment opens a large potential market in the schools. Many American secondary schools are teaching earth sciences, including meteorology. Such equipment would fit naturally into such a curriculum.

ESSA II (Environmental Survey Satellite II) is the second of two weather satellites in near polar orbits that make up the first operational weather satellite system. It was launched on February 28 by the National Aeronautics and Space Administration on behalf of the Environmental Sciences Service Administration, also called "ESSA."

ESSA I, launched on February 3 stores its views of global weather on tape. This is dumped daily over one of the special American ground stations.

ESSA II, on the other hand, has no tape storage. It broadcasts directly via the Automatic Picture Transmission (APT) system first tested with the Tiros 8 satellite.

It is these transmissions that can be picked up by anyone with relatively simple aerials and receivers and printed out on the same kind of facsimile recorder that now transcribes weather maps.

ESSA plans, from now on, to have one satellite of each type orbiting at all times. When a satellite in orbit fails, a replacement will be speedily launched.

Besides being in near polar orbits, the satellites are "sun synchronous." This means they appear over the local horizon at roughly the same time each day. This feature of regular availability adds considerably to their usefulness.

All makers of facsimile equipment are interested in the new markets the APT transmissions may open. Of the two major American producers in the field —Fairchild Hiller Corporation and Alden Electronic and Impulse Recording Equipment Co.—it is Alden that is talking about equipment for under $A7,500.

Irving R. Tatro, Manager for Meteorlogical Systems, discussed this during a visit to Alden's research centre in Westboro. At the time, he was testing a stacked Yagi aerial tuned to 137.5MHz It was quite similar to a TV aerial, with small motors that allowed it to scan.

Mr Tatro said that, by just aiming the aerial for the centre of an ESSA pass, you can get at least two pictures. To get the three, four or even five pictures possible on a pass, however, you have to track "within reason." This is done by listening to the audible tone of the transition.

The aerial, bought by Alden from the Cush-Craft Company in Manchester is light, rugged, and quite portable. Mr Tatro said he has no trouble setting it up in a yard or on the back of a small truck. Buying such an aerial off-the-shelf is one way of holding down the ground station costs.

The biggest expense for a system, Mr Tatro said, is the facsimile recorder. Alden sells it for just over $A2,500.

At such a price, many individual schools could afford a station. For large school systems, such as those of New York or London, a few such stations could be mounted on trucks, They could be moved from school to school as needed. The recorders could be set up in classrooms while the aerial is mounted in the yard or on the roof.

The APT pictures from ESSA II show most of the detail it is possible to extract from the transmissions. Each picture covers an area roughly 2,000 miles square.

It has 800 scan lines and a resolution of about two miles directly below the camera. Any one ground station should receive pictures from two or three orbital passes per day.

The ability to pick up such pictures of surrounding weather every day would be a boon to schools and local television stations. ("Electronics Weekly," 23/3/66.) ◘

SUPER-CLEAN MILK BOTTLES BY ELECTRONICS

A new machine, said to be the first of its kind in the world, has been developed in the U.K. by Fords (Finsbury) Ltd., of Bedford, and Tube Investments Research Laboratories, to inspect automatically newly washed milk bottles at a rate of 400 a minute. The system is self-contained and can be fitted to the usual kind of bottle conveyor between the washing and filling stages.

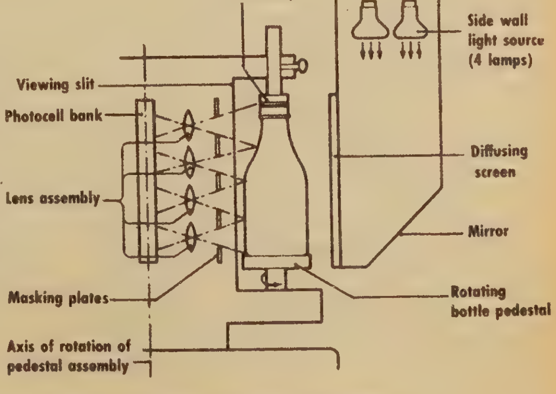
Light beams are used to scan the base and walls of each bottle and phototransistors and barrier layer photocells detect cracks or chips and any particles of foreign matter which may have survived the washing process. The suspect bottles are automatically rejected for further inspection. This reduces the number of bottles requiring visual inspection to a very small and easily manageable proportion of the throughput.

The machine, which is entirely transistorised and based on plug-in printed-circuit boards, offers a standard of product quality never before attainable.

The operation of the machine is such that an input conveyor feeds bottles to a starwheel that traverses the base scanner. If unsatisfactory, the bottle initiates a reject signal that is passed to a memory store and the bottles are transferred to a rotating wall scan system. Again if any bottles are unsatisfactory, reject signals are initiated and stored. Another starwheel transfers the bottles to the output conveyor, reject bottles being diverted either to a reject table or to a further conveyor to be examined and rectified or discarded. An important feature is that movement is continuous and at a constant speed which prevents damage to the bottles.

Having developed this automatic milk bottle-inspection machine for use with clear glass, Fords are now exploring the field of coloured glass, first dealing with pale green and brown bottles and ultimately dealing with the dark green and brown glass that is widely used in breweries. ("Electronics Weekly," 10/8/66.) ◘

Light passes through the spinning bottle, via a vertical scanning slit, horizontal masks and lens systems to a bank of photocells. Each cell is divided into five zones, giving fine vertical discrimination.



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SCIENTIFIC AND INDUSTRIAL NEWS

Retrieving "lost" space information

A new technique for retrieving valuable information from apparently indecipherable tape recordings of spacecraft missions s being developed by N.A.S.A. scientists and engineers at the Goddard Space Flight Center in Greenbelt, Maryland.

This information was formerly thought "lost" because of occasional "noise" or "static" recorded during transmissions from spacecraft to ground stations. It now is being recovered by a unique data processing installation that incorporates a new IBM 1800 data acquisition and control system.

The IBM 1800 computer provides the recognition and recording functions required in the data retrieval technique. A special tape unit reads and rereads the original recordings for the computer.

In addition to analysing tapes, the IBM 1800 will be used to help N.A.S.A. scientists and engineers design and build improved spacecraft data systems. It also will be used to check out spacecraft data systems, eliminating the need to develop special testing devices for each new space probe under the Goddard program.

The IBM 1800 installed at the Flight Data Systems laboratory at Goddard is capable of storing 8,192 words of information, each of which is available within 2 microseconds. All information processed by the 1800 is in binary form.

Also connected to the system are: an IBM 2310 disc drive—a unit that incorporates a single magnetic disc to store programs; an IBM 2400 series tape drive for recording of data; an IBM 1816 printer; and an IBM 1442 card reader.

TV cameras for air traffic control

The Ministry of Aviation in the U.K. has ordered 31 Marconi solid state closed circuit television cameras for air traffic control and training applications. Of these, 14 will be used for procedure studies at the Air Traffic Control Evaluation Unit and the Air Training School at Hurn Airport. Flight path, area control and stacking systems will be evaluated with the cameras, by transferring data from edge-lit perspex screens to the radar controllers. This television system has been designed for integration into a computer air traffic control system, when required.

At London Airport, seven of the cameras, with a spare channel, will watch flight progress strips to provide data to the controllers about vacant altitudes in two aircraft stacks.

The remaining channels will go the Southern Air Traffic Control System for addition to its existing system; to Gatwick, where the telecommunications engineering unit will employ two channels for maintenance and training purposes; to Bletchley, in Buckinghamshire, for the training of telecommunications officers at the Civil Aviation Signals Training Establishment; and to the new R.A.F. traffic control centre at West Drayton, where three channels will be used to feed the procedural controller with information about airfield readiness and hazards plus the latest meteorological data.

New organic dye lasers

A new family of lasers that have both the extremely high output power of a giant pulse ruby laser and the very small beam divergence of a gas laser has been reported in the U.S.A. by scientists of International Business Machines Corporation, Yorkton Heights, N.Y. A wide range of new giant pulse frequencies can be generated by the devices.

The laser system uses an organic photosensitising dye in solution as the active medium. The dye is pumped by a giant-pulse ruby laser. Because the dye solution is of much higher optical quality than the crystal in a ruby laser, the output of the dye laser has the extremely high spatial coherence previously available only in gas lasers.

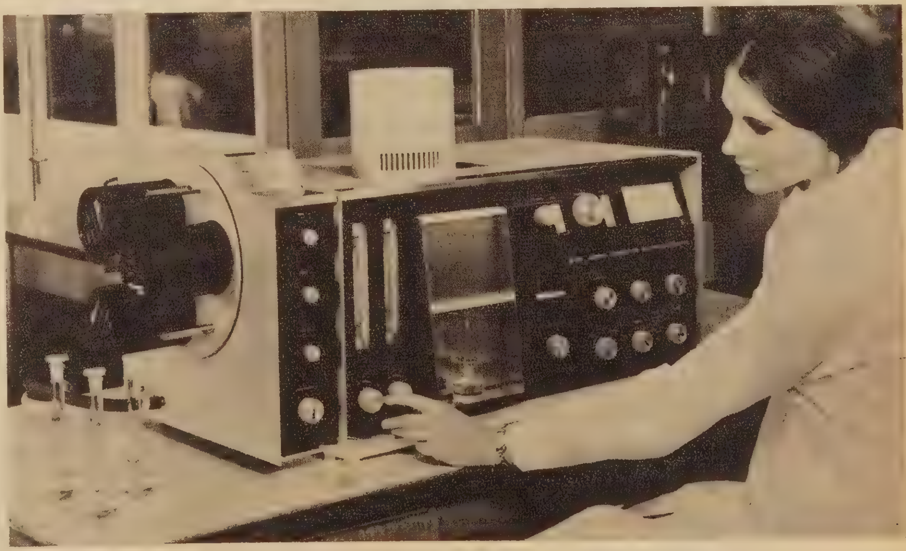
The small beam divergence of the new laser is of potential interest for a variety of giant pulse laser applications, such as long-range laser radars and range finders.

Metal mills for Elizabeth

Two new metal processing mills to cost about $2.75 million and to employ 150 men are being considered by Texas Instruments Ltd., as additions to its plant at Elizabeth, S.A. The company hopes to build the first of the new mills within about 18 months.

Announcing this, the company's Australian managing director, Mr David Powers, said it was feasible to begin production in Australia of a new type of copper-aluminium wire to replace pure copper wire in many applications. It was intended that the first of the new mills would produce the wire, sales of which could be expected to top $12 million annually. The second mill was being considered for multi-layer strip metals.

The company's metallurgical division manager, Mr William Miles, said he believed materials from both mills would find export markets in Asia, and that the copper-aluminium mill would be only the second of its kind in the world. (The first is owned by Texas Instruments in its Attleboro plant, in U.S.A.) The production method was perfected in March this year, and basically involves sheathing copper over an aluminium core. In many applications it is said to be able to cut wiring costs by as much as 25 per cent.



The Unicam SP 90 Atomic Absorption Spectrometer seen here is a new instrument which has rapidly found an astonishing diversity of applications in all analytical fields. This diversity stems from its ability to detect and estimate more than 60 elements in large or small quantities, down to one part in one hundred million.

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4-Pole constant velocity (15 watt) Motor. Speed variation continues from 15 to 80 R.P.M. with Click stop at 16—33⅓—45—78 R.P.M. Wow & Flutter Maximum 0.2%; Rumble and Hum negligible. Turntable 12" x 8 lb. Unit: 15⅜" Long; 13¼" Wide; 5½" High.

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The new Goldring Lenco GL70 Transcription unit is unique. It features an 8 lb. non-magnetic diecast turntable dynamically balanced with lapped steel centre spindle running in sintered bronze bush bearings. The on-off switch automatically disengages the idler wheel from the turntable underside, preventing "flats" developing and also operates a microlift mechanism for the pick-up arm, allowing precise selection of record track and manual lowering of pick-up head. The positive vertical drive system allows for continuously variable turntable speeds. Adjustable pick-up arm with detachable head shell.

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GE:P343

lew super conductor discovered

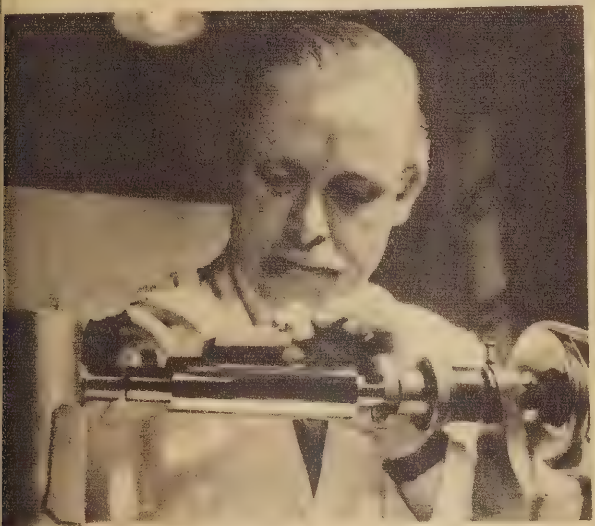
A better understanding of the properties of alloys containing tinum-group metals is expected to result from studies being nducted jointly at the N.B.S. Institute for Materials Research .S. Department of Commerce) and the U.S. Navy Marine gineering Laboratory (Department of Defense).

These studies have been conducted by R. M. Waterstrat, research associate of the American Dental Association at B.S., and Dr E. C. van Reuth. a senior research scientist at Navy Marine Engineering Laboratory. As a result of this vestigation, a chromium-osmium alloy was discovered to be superconductor.

V translator station opened

A National television translator station to serve the arrnambool/Port Fairy area of Victoria began regular operans on October 14, and is the fifth to be established in ustralia. The station is located on Tower Hill, one mile south Koroit. It operates on 50 watts, and relays on channel 2 e programs of the national station ABRV3 at Ballarat.

The new translator is located in the same building as a mmercial service translator already operating in the area.



A foreman of Rank Taylor Hobson's special projects department puts the final polish on a replica mirror for a spectroheliograph, shortly before it was shot 150 miles into space from Woomera. The spectroheliograph was designed to collect X-rays from the sun to assist scientists in solar studies. It is manufactured to a tolerance of a hundred thousandth of an inch.

The all-electric bike

A battery-powered motor-cycle which is virtually silent and will sell in U.K. for under £100 sterling ($250) has been developed by Telearchis Ltd., of Lechlade, Gloucestershire. The Winn City-Bike, as it is called, has a top speed of 30 mph and will do between 12 and 20 miles on a single charge of its battery. A full recharge takes six hours, so continuous use would require keeping spare batteries handy. However, the makers point out that the machine is intended for short-haul work — commuting, shopping, inter-office deliveries, running around farms and factories, and so on. Electricity costs are said to be only a few cents a week, however much the machine is used.

The designer, Russel Winn, thinks he has solved the problem of power-to-weight ratio which has long delayed the development of electric motor-cycles.

Coloured icebergs are easy to see

U.S. Navy pilots are experimenting with a new bombing technique that will save lives instead of destroying them. Their targets are icebergs which menace ships using the North Atlantic.

Icebergs are continuous danger to fishing fleets, passenger and cargo vessels and warships. One of the biggest problems in averting collisions is seeing them in time to take evasive action.

To solve this visibility problem, the United States Navy has undertaken a program to mark with brilliant red dyes icebergs detected by patrol planes. One of the dyes successfully tested is the Cyanamid Company's Rhodamine red dye.

The dye-bombing technique requires great skill on the part of Navy pilots. The dye is stored in one-gallon glass jars, which are dropped from the planes flying 75 feet above the iceberg. The jars smash on impact and the dye spreads over the face of the iceberg. Bergs examined 15 days after being marked were brilliantly coloured and visible for miles. The U.S. Navy believes the dye will remain until the icebergs melt in warmer waters and no longer are a danger to approaching ships.

More international television

Now accepted as a household word in Britain and other European countries is the term "Eurovision," in relation to international television exchanges between European television authorities. With the start of intercontinental program exchanges via satellites, the term "Intervision" has gained currency. Till recently the African continent had not taken part in any international exchanges, but now another milestone has been passed with the transmission of live programs between Britain and North Africa, in both directions.

The first of these programs to be shown on British TV screens was "Direct From Tunis," a special edition of B.B.C. Television's program "Twenty-four Hours." However, programs from Britain to Tunisia had already been inaugurated with World Cup Football telecasts. Now British observers are wondering whether the word "Afrovision" will enter the vocabulary.

Earlier this year, Tunisia started its own television service, and now has some three hours of programs a night, and an estimated 5,000 sets in and around Tunis, whose owners were able to watch the World Cup from London via the southbound link. The new link goes from Cape Bon in Tunisia to Monte Trice in Sicily, from there to the Italian mainland, and then by the Eurovision network to London.

Watch-keeping by electronics

Up to 100 points in a ship's engine-room at which temperature, pressures, flows, levels, etc., are recorded, can be monitored continuously by means of automated logging and trend recording equipment produced by Monitor and D.P. Controls, King's Road, Wallsend-on-Tyne, England.

The main information is presented on an X-Y plotter in graphical form and, on a normal scan, it takes 10 minutes to cover the 100 vital points. Only alarm figures are printed, but a read-out of all points can be obtained in 50 seconds when required.

The transducers which convert the physical quantities from

This is the control room of one of the flying radio and television stations, known as "Blue Eagles," which broadcast programs to civilian and military personnel in South Vietnam, operating under the command of the U.S. Navy Oceanographic Unit. The Lockheed Aircraft Service Company modified their C-121J Super Constellation aircraft for this purpose. In addition to this control room in the forward part of the fuselage, the modifications also include a soundproof studio to permit live broadcasts from the aircraft, installation of power sources and mounting of aerials.

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DIVISION OF ELECTRONIC INDUSTRIES LIMITED he various sections of the ship's equipment into voltage signals ary according to their use. For pressure measurements, strain auges mounted on diaphragms are used and for temperature eadings, thermocouples (though resistance thermometers may also e used) .

Flap-type flow indicators and float-type level gauges are con- ected to potentiometers with outputs proportional to flow or evel. Tachogenerators can be connected to revolving machinery o give rpm. All circuits are housed in one console and a et of test cards is provided.

Perth-Carnarvon co-axial cable

A 612-mile long four-tube co-axial cable from Perth through Geraldton to Carnarvon is to be built by the Post Office at a cost of $7-million. The Postmaster-General, Mr Alan Hulme, said that able laying would commence in the second half of 1967 and the system should be ready to begin operating late in 1969. Initially he system would be capable of providing up to 1,200 telephone channels, and television relay facilities, if required.

Mr Hulme said that the cable would be wholly manufactured in Australia as would a substantial portion of the electronic equipment. The cable system was designed to benefit centres to the side of the main route in addition to those directly along it. By the end of 1969 the Post Office would have co-axial cable and micro-wave radio trunk systems stretching from Carnarvon south around Australia's coastline and up to Cairns—a distance of over 5,000 route miles. A major link would also reach south from Melbourne to Hobart. Mr Hulme added that the plans to extend the Perth-Carnarvon system to Port Hedland were still under consideration.

Assembly of the satellite communications ground station on Ascension Island in the South Atlantic for the U.S.A.'s "man on the moon" project has been completed by Britain's Marconi Company for Cable and Wireless Ltd. The picture above shows the completed aerial structure during final tests at the Marconi experimental station in Essex, England, and (right) the console from which the operation of the entire station is controlled and monitored.

High-efficiency light-emitting diodes

The efficiency of gallium arsenide light-emitting diodes has been sharply increased by a new fabrication technique developed by scientists of International Business Machines Corporation, the company claims. Diodes made with the new process typically have an external quantum efficiency of six per cent as compared with previously reported values of one to two per cent.

The key to the performance of the diodes is the success of the IBM group in getting silicon to serve as both an N-type and a P-type dopant. Known as amphoteric doping, this effect has only rarely been observed before and has not previously been applied to useful devices. Silicon is a deeper acceptor than zinc, which is commonly used as the P-type dopant in GaAs, so the light emitted by the new devices is of lower energy than that from Zn-doped diodes. Since the energy of this light is considerably less than the bandgap of GaAs, absorption of light within the diode is sharply reduced. This lowered internal absorption is believed to be the chief reason for the much higher external quantum efficiency of Si-doped diodes.

Details of the new fabrication process are given in the current issue of Applied Physics Letters in a paper by Hans Ruprecht, Jerry M. Woodall, Karl Konnerth, and G. D. Pettit of IBM's Watson Research Centre, Yorktown, N.Y.

Ceramic CRO with electrostatic focus

The Electronics Department of Ferranti Ltd., Gem Mill, Oldham, Lancs., U.K., has introduced what is believed to be the first ceramic envelope cathode ray tube with complete electrostatic focus. Designed to withstand severe environmental vibration, the new tube combines very high resolution with a useful screen diameter of only 0.5in (12.7mm), features which enable the same amount of information to be displayed as would normally be available only with much larger tubes.

As ceramic tubes are intended for use under conditions of very high vibration, it is essential that the focus and resolution of the tubes should not deteriorate. To achieve this necessary high degree of stability it is important that there is no relative vibration between the envelope of the tube, the electron gun and the focusing system.

In a ceramic tube the components of the electron gun are formed either on metallised surfaces on the inner wall of the ceramic envelope, or as metal discs which are sealed to the walls. The electron gun therefore becomes a part of the ceramic envelope thereby completely eliminating any relative vibrational displacement between the gun and the tube.

Slow motion TV

A special BBC Designs Department gadget showing in slow motion exciting periods of play is now being widely used in televised sports programs. The gadget, which was introduced during the 1966 World Cup matches, can, for example, show a goal within seconds of it taking place, and can be used to hold a picture indefinitely so that viewers can study how the ball entered the net or narrowly missed it.

The two main parts of this slow/stop motion equipment are a video tape recording machine and a magnetic disc machine, modified by the B.B.C. Designs Department. The video tape machine records the whole match. If a special section is to be shown in slow motion, that part of the recording is played back at slow speed and fed to the magnetic disc which makes four images of each picture. This gives the slow motion effect; for stop-motion a single picture is repeated indefinitely.

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Impedance : 50 kΩ
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†Sensitivity : −52 dB ±3 dB,
Dimensions : 148×48×34.5 mm without stand
Cable : 4 ϕmm, 3 m
Weight : 1¼ lbs (525 g)

DF-1DE

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~10,000 c/s ±8 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 385.5 mm high
21 mm diameter, microphone
128 mm diameter, stand
Cable : 4 ϕmm, 1.5 m
Weight : 1⅝ lbs (840 g) with cable

*DF-14B

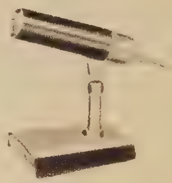
SPECIFICATIONS
Impedance : 50 kΩ Variable
Frequency Response : 100~10,000 c/s ±8 dB
†Sensitivity : −48 dB ±3 dB,
Dimensions : 136×75×47 mm
Cable : 6 ϕmm, 4 m
Weight : 2 lbs (900 g)

*DF-22B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s ±7 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 32.5 mm diameter, 220 mm long
Cable : 6 ϕmm, 4 m
Weight : 1¼ lbs (575 g)

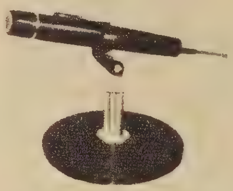
DF-1/*DF-1B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s ±8 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 21 mm diameter, 82.7 mm long
Cable : 3 ϕmm, 1.5 m
Weight : 3.9 oz (110 g) with cable



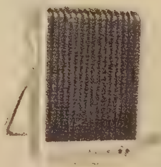
DF-3

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s ±8 dB
†Sensitivity : −56 dB ±3 dB,
Dimensions : 33.5 mm diameter, 133 mm long
Cable : 4 ϕmm, 1.5 m
Weight : 9.0 oz (255 g) with cable



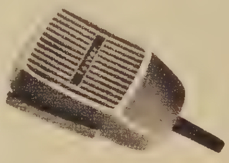
DF-12/*DF-12B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 80~12,000 c/s ±8 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 23 mm diameter, 158 mm long
Cable : 3 ϕmm, 1.5 m
Weight : 6.3 oz (180 g) with cable



*DF-2B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s ±10 dB
†Sensitivity : −56 dB ±3 dB,
Dimensions : 75×53×30 mm
Cable : 3 ϕmm, 1.5 m
Weight : 4.8 oz (136 g) with cable



*DF-51B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~8,000 c/s ±7 dB
†Sensitivity : −57 dB ±3 dB,
Dimensions : 98×58×36 mm
Cable : 6 ϕmm, 1.6 m, Coiled
Weight : 7.3 oz (207 g) with cable

* with switch : † at 1,000 c/s, 0 dB = 1 V/μ bar

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SCIENTIFIC NEWS — cont.

Britain's 100 reactor years

Britain has accumulated 100 "reactor-ears" of operating experience in the generaon of electricity from nuclear power, aid Mr J. C. C. Stewart, Member for reactors, United Kingdom Atomic Energy Authority, when he addressed nuclear exerts from all over the world at a nuclear exhibition and conference, "Nuclex '66" n Basle. "Our experience with gas-ooled graphite-moderated reactors has proved them reliable and safe," Mr Stewart said.

"The lessons learnt in commissioning and perating nuclear power stations through heir early years is proving invaluable as new stations are integrated into our natonal electricity network. A young generaion of nuclear engineers has matured with he nuclear stations which — to them — are quite "conventional" in operation.

"We, in the United Kingdom, have placed great emphasis on the development of safe reactors. An independent team of safety experts has devoted some 500 man-years of specialist effort to this work and in my opinion the advanced gas-cooled reactor is the safest power reactor commercially available in the world today."

Atomic battery progress

Work has been in progress for several years in a number of countries on ways of using the heat produced over many years by radioactive substances as a source of power for industry — lighthouses, cable repeaters, microwave link amplifiers, remote weather stations and the like.

To explore what has already been achieved, the European Nuclear Energy Agency recently brought together representatives of research organisations and industrial companies within its area in a symposium at Harwell, England. The symposium studied types available, their safety and the economics of their use.

British work in this area has concentrated on the development of a one-watt generator which would operate for five years without attention or replenishment. It is intended to install generators of this type in United Kingdom and Swedish warning beacons for maritime use.

Nuclear power increase

The rapidly growing importance of nuclear power generating stations is underlined by the O.E.C.D. in its latest annual survey of the electricity industry in its member countries. After 1966, it reports that some experts now predict between 30 and 40 per cent of all new plant will be nuclear fuelled, with coal burning equipment accounting for most of the remainder.

The development of "turnkey" nuclear plants has enabled constructors to make considerable economies with the result that in certain cases tender prices have fallen to $120 per kilowatt—a figure that had previously only been thought possible after 1970.

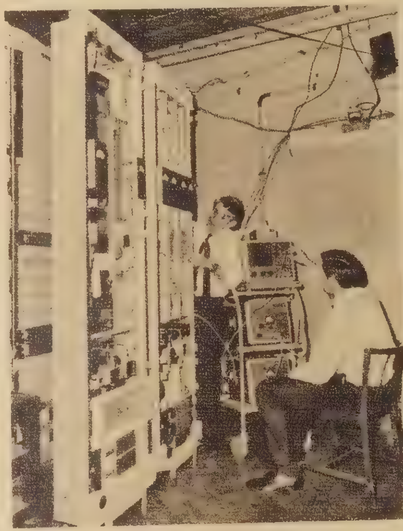
Aircraft electronics for hire

The Aeronautical Division of The Marconi Company has inaugurated an over-the-counter hire service at London (Heathrow) Airport, for their range of aircraft electronic equipment. This unique service will enable any airline or executive aircraft operator with Marconi equipment, to obtain replacement units rapidly and at a reasonable charge, while his own units are being repaired, making it unnecessary to hold extensive stocks of spares.

Spare units can be hired under the new service, for periods as short as a week, and will be available on request at the Company's Service Depot in the No. 1 Maintenance Area at London (Heathrow) Airport. Fixed price maintenance agreements can also be provided on a long term basis, according to customer requirements and aircraft utilization.

Water desalting

Israel patent rights have been taken out for a seawater desalination process claimed to cut production costs to about half those of any known method. According to the inventor, Mr Moshe Goldberg, 9 Akiva Eiger Street, Tel Aviv, the patent, which uses the vacuum freezing method, covers a new technique. Instead of drawing off the vapour from the vacuum chamber in which freezing takes place the vapour is condensed in the same chamber by a special method.



At the G.E.C. (Telecommunications) works at Coventry, England, engineers test 2000MHz transmission equipment of the type which will be used on the proposed Perth-Adelaide telecommunications radio link. Main suppliers of the radio equipment will be G.E.C. (Australia) Pty. Ltd., who will make or sub-contract about two-thirds of the equipment locally, but will import the more specialised equipment from its associated English company.

A spray injects the sea water into the vacuum chamber exposing as large and as shallow an area of water as possible to the freezing influence of the vacuum. An agitator then ensures maximum exposure of the mass to the freezing process.

The reduction in production costs stems from a lower initial investment, the installation required being considerably smaller than usual, and from lower electricity consumption. A unit capable of producing 2,000 cubic metres of desalted water a day is said to cost $150,000 to construct.

Mechanical valves

The increase in air-operated numerically controlled machine tools has created a demand for mechanical valves which convert weak-signal air impulses into pressures strong enough to move actuators. They are not fluid logic devices since they have moving parts.

An example of this type of mechanical valve is offered by the Powers Regulator Company, of 3,400 Oakton Street, Skokie, Illinois. It will receive a puff of air from a sensor and turn on a higher pressure to operate a cylinder. Or it can be programmed to send its own signal impulse after the cylinder has been set. ▬

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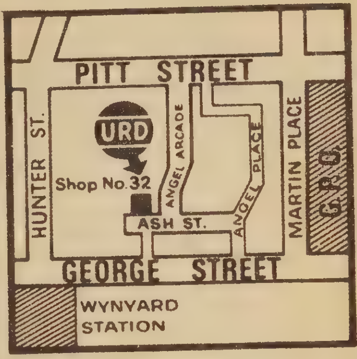

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Logic and counting circuits — 7

BCD - Decimal DECODING

Encoding and decoding—the concept of "sufficient definition"—equivalent functions—choice of logic—sequential or "tree" decoders—parallel decoders—representing a parallel BCD decoder using a matrix—bi-quinary decoding—a decoder for the twisted-ring decade counter.

by Jamieson Rowe

As we noted in earlier articles of this series, most digital circuitry deals with electrical representations of numerical information. And in order that the information may be processed with a high degree of reliability and convenience, it is usually handled not in the decimal notation with which human beings are most familiar, but either in **binary** (base-two) notation or in one of the many special notation **codes** developed for this purpose.

In view of the differing requirements of human beings and digital circuitry, and in order that both may operate efficiently, it becomes important to allow each to handle information in the form for which they are best suited, while at the same time providing for effective man-machine communication. An essential part of digital equipment is thus the information **transformation** facilities at both "input" and "output."

In the last article, it may be recalled, we looked at the "readout" devices used to produce a visible display from the numerical output of the equipment. Let us now turn to another equally important aspect of transformation: the circuitry used to translate digital representations from one numerical notation system to another.

A suitable name for this aspect of transformation is "code translation." For convenience it is usually conceived as consisting of two complementary operations: **encoding,** wherein the numerical information is translated from decimal notation into a code, and **decoding**—the reverse operation of translating from a code back into decimal notation.

Encoding and decoding being complementary operations, the circuitry involved in the one is usually a functional if not an electrical dual of the other. This being the case, it is not proposed in the present article to deal with both separately. As decoding circuitry is encountered somewhat more frequently than that employed for encoding, it will be the former which will be used mainly as the basis for discussion.

To begin, then. As already stated, decoding is the operation of deriving electrical representations of numerical information in decimal notation from those either in pure binary notation or in one of the many codes. Naturally enough, the aims in decoding are to perform this task both accurately and reliably while using a minimum of circuitry and components. Reference to the diagram of figure 1 and its associated truth table should help in understanding how these aims are achieved.

The diagram may be recognised as the logic diagram of a ripple-carry decade counting register using J-K flip-flops and counting in the so-called 2421 BCD code. The first four data columns of the truth table are by way of recapitulation and show the value states of the flip-flops for each of the ten decimal digits. Note that the lateral order of the flip-flops is transposed in the table to follow the usual convention wherein the bits are arranged from right to left in order of significance or "weighting."

As noted in an earlier chapter the essential point in both counting and other digital circuitry is that there is a unique combination of bits used to represent each decimal digit. Thus inspection of the truth table of figure 1 will show that for every decimal digit there is a unique combination of flip-flop value states.

A moment's thought should show that we can thus derive signals representing the decimal digits from such a register or similar digital circuit, by employing logic circuitry to sense whichever of these unique value state combinations is present at any given time and to deliver an appropriate output. This is the general principle used in decoding.

It might have been assumed from the foregoing that the logical circuitry employed in decoding would have to be arranged to sense the state of **all** the elements in a register or circuit. This is certainly true in the case of pure-binary decoding; however, with many of the BCD and other codes it is often the case that a majority of the decimal digits may be defined adequately by sensing only **some** of the elements. Techniques of logic minimalisation are thus employed to determine the **sufficient definition** for each decimal digit in the code concerned.

For example, in the 2421 BCD code used in figure 1 there is no need to sense the value state of FFD for each of the decimal digits 0—5, because in each case the combination provided by the three remaining elements is sufficient to define the combination uniquely among the ten possible combinations. To define decimal 4, for example, we need only stipulate that FFC must be set (Y=1) and FFB and FFA both reset (Y=0); there is no other decimal digit for which this smaller combination occurs, so it becomes unnecessary to include the value state of FFD in the definition.

For decimals 8 and 9 in the same code only the value states of FFD and

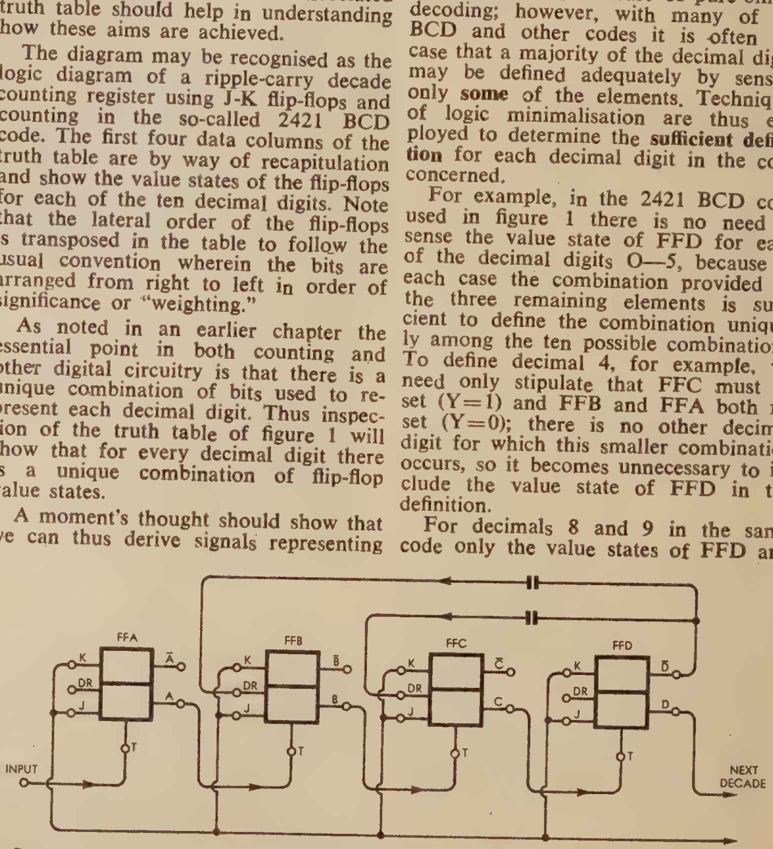


Fig. 1

2421 BCD RIPPLE CARRY REGISTER

DECIMAL	FFD (2)	FFC (4)	FFB (2)	FFA (1)	SUFFICIENT DEFINITION	EQUIVALENT FUNCTIONS
0	0	0	0	0	-000	$\bar{C}.\bar{B}.\bar{A}$, $\overline{C+B+A}$
1	0	0	0	1	-001	$\bar{C}.\bar{B}.A$, $\overline{C+B+\bar{A}}$
2	0	0	1	0	-010	$\bar{C}.B.\bar{A}$, $\overline{C+\bar{B}+A}$
3	0	0	1	1	-011	$\bar{C}.B.A$, $\overline{C+\bar{B}+\bar{A}}$
4	0	1	0	0	-100	$C.\bar{B}.\bar{A}$, $\overline{\bar{C}+B+A}$
5	0	1	0	1	-101	$C.\bar{B}.A$, $\overline{\bar{C}+B+\bar{A}}$
6	0	1	1	0	0110	$\bar{D}.C.B.\bar{A}$, $\overline{D+\bar{C}+\bar{B}+A}$
7	0	1	1	1	0111	$\bar{D}.C.B.A$, $\overline{D+\bar{C}+\bar{B}+\bar{A}}$
8	1	1	1	0	1--0	$D.\bar{A}$, $\overline{\bar{D}+A}$
9	1	1	1	1	1--1	$D.A$, $\overline{\bar{D}+\bar{A}}$

FA need be defined, as these states are ufficient to differentiate the full cominations concerned from all others. However, in contrast, decimals 6 and 7 an only be defined adequately by using ll four of the value states. These esults are summarised in the truth table in the column headed "sufficient definition."

Note that whereas sensing the full combinations for each decimal digit would involve the logic circuitry in sensing a total of 40 value states, in fact it is only necessary to sense 30 of these —an average of only three value states per digit and a saving of 25 per cent in the overall operations required from the logic circuitry. Similar savings in circuit complexity and cost are attainable with many other numerical codes. Minimalisation of digit combinations to arrive at their sufficient definitions is thus time and effort well spent.

By its very nature, decoding circuitry is concerned with situations involving logical conjunction: each decimal output must be energised only when there occurs the particular combination of code inputs to which it corresponds. In short, decoding is basically a logical AND function.

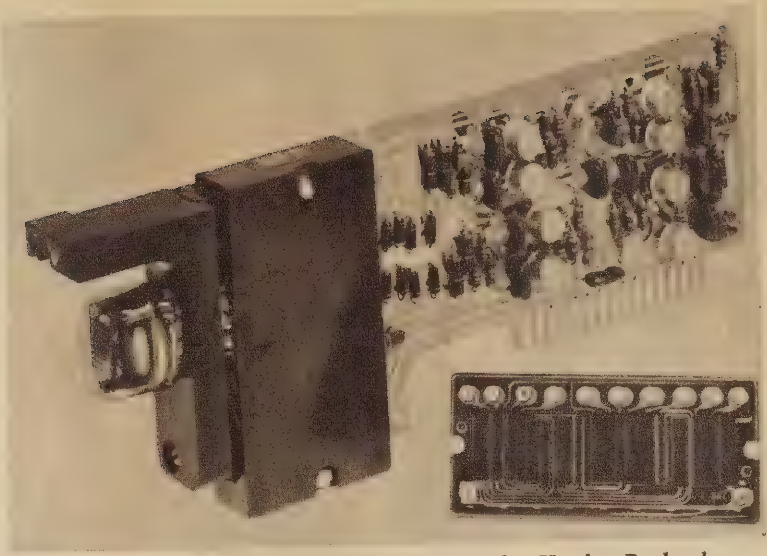
While this may seem to suggest that decoding logic circuitry must use AND elements rather than OR, NAND or NOR elements, this is not the case. As we saw in earlier articles, any logical function may be synthesised using either NAND or NOR elements solely, while the same applies to combinations of AND and NOT or OR and NOT elements. Not only this but most practical logic elements may be arranged to perform any of the logical functions simply by interpreting their behaviour from a suitable logic polarity convention.

From this it should be fairly apparent that there exist a number of equivalent logic functions corresponding to the sufficient definition of each decimal digit. To illustrate this the final data column in the truth table of figure 1 shows both AND and NOR functions equivalent to the sufficient definition concerned from a decoding viewpoint.

The type of logic employed in a decoding circuit is but one of a number of somewhat interdependent factors which are varied by the designer to arrive at the desired performance and reliability with minimum cost.

A second of these factors is the numerical code for which the decoder is being designed. Some codes lend themselves to more economical decoding using AND elements, others to more economical decoding with, say, NOR elements, and so on.

A third factor is the actual logic configuration used. With each code there is usually a particular configuration of one of the types of logic element which will require a minimum of elements or wiring, or both.



This late-model decade counting module by Hewlett-Packard uses a neon lamp-photoconductor "tree" decoder. The photoconductor assembly has been removed to show its construction. (Courtesy Sample Electronics (N.S.W.) Pty. Ltd.)

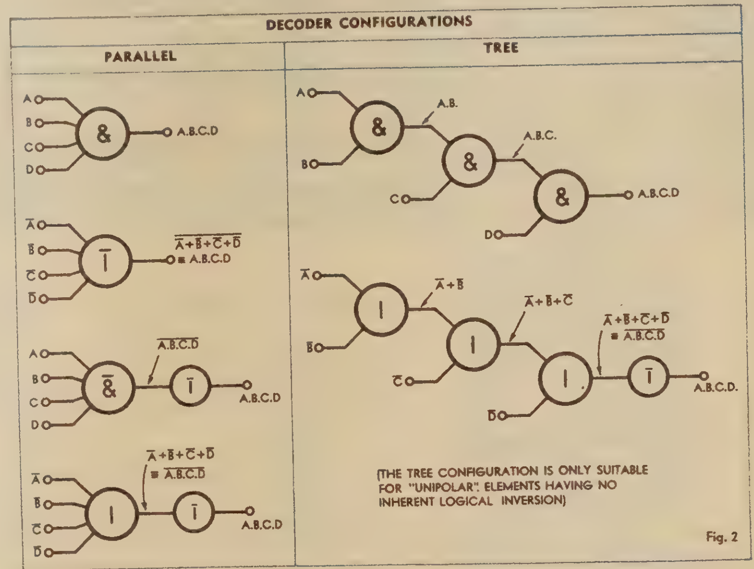

DECODER CONFIGURATIONS
PARALLEL
TREE
A
B
C
D
&
A.B.C.D
$\overline{A}$
$\overline{B}$
$\overline{C}$
$\overline{D}$
$\overline{\overline{A}+\overline{B}+\overline{C}+\overline{D}}$
= A.B.C.D
$\overline{A.B.C.D}$
A.B.
A.B.C.
$\overline{A}+\overline{B}$
$\overline{A}+\overline{B}+\overline{C}$
$\overline{A}+\overline{B}+\overline{C}+\overline{D}$
= $\overline{A.B.C.D}$
A.B.C.D.
(THE TREE CONFIGURATION IS ONLY SUITABLE FOR "UNIPOLAR" ELEMENTS HAVING NO INHERENT LOGICAL INVERSION)

Fig. 2

A fourth closely related factor is the actual device used for performing the logic. The type of device used is often a function of the speed required and cost considerations, while itself determining to a large degree the configuration and type of logic to be used.

The discussion and examples which follow should help the reader in understanding the way in which these factors are inter-related.

There are two general logic configurations available for decoding. These are the **parallel** configuration and the sequential or **tree** configuration. Decoding may be performed using either of these configurations or a combination of both.

The two configurations are illustrated by the diagrams of figure 2, which compare the gating required in each case for a hypothetical decimal digit having a sufficient definition equivalent to A.B.C.D. The alternative diagrams in each column show the way in which various logical elements may be used in the same configuration.

Note that while there are four basic logic types which may be used for the parallel configuration, only two are suitable for the tree configuration: AND and OR. Because of the "distributed" logic performed by the tree configuration the NAND and NOR elements are not suitable, as their inherent inversion results in overall disjunction.

The only way that such elements may be used is by either mixing elements or by combining both parallel and tree configurations — or both. These are further possibilities open to the designer seeking the most economical design.

It should also be noted that the use of some element-configuration combinations requires complementary inputs. While in most decoding situations these are already available from the flip-flops or other source elements, this may not always occur. In such situations it is usually easier to employ a more suitable element-configuration combination than to add the inverters otherwise required.

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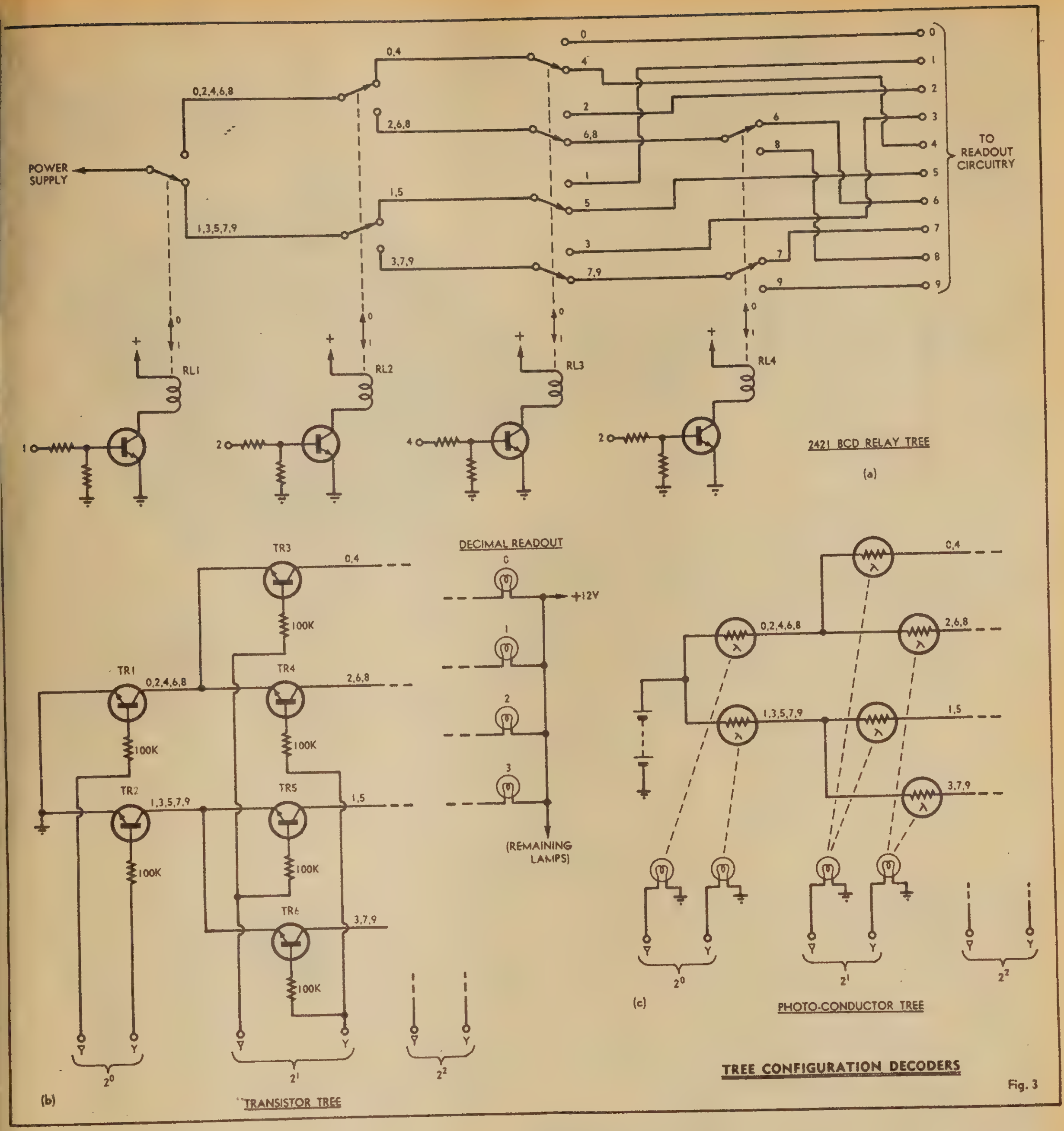

TREE CONFIGURATION DECODERS

Fig. 3

this stage that most decoders require complementary inputs for at least some of the decimal output digits. Reference to the equivalent functions shown in figure 1 shows the number required in decoding 2421 BCD.

Being a logical operation, decoding may be performed by a variety of different device and circuit elements. Many of the devices and circuits discussed in the second article of this series are thus quite suitable — for example, junction diodes, neon tubes, four-layer diodes, thyristors and transistors. In addition it is often possible to use relatively low speed devices such as relays and photoconductive resistors, as in many decoding applications extremely rapid response is not essential.

The diagrams of figure 3 show three examples of practical decoders which use the tree configuration.

Diagram (a) shows a decoder using relays, which were probably the first devices used in this configuration. Although relatively slow in operation, relays are well suited to the tree configuration as a single relay can operate many sets of changeover contacts.

Each relay changeover contact set is logical equivalent to a pair of alternatively "open" AND gates; the moving contact represents the common input of the two gates, while the two fixed contacts represent the output of the gates. When the relay is not energised, one gate of each "pair" is open and the other closed; energising the relay effectively reverses the situation.

Thus for the 2421 BCD decoder shown, relays RL1, RL2, RL3 and RL4 are effectively controlling two, four, eight and four AND gates respectively. Which decimal output line is connected to the power supply fairly obviously depends upon the combination of signals applied to the relay drivers, energising the relays and opening the appropriate combination of gates.

As shown RL1 and RL3 are energised, effectively opening the three AND gates in the line to the "decimal 5" output terminal. Reference back to figure 1 will verify that 5 is the appropriate decimal digit for this relay energising pattern, which corresponds to 0101 in the code concerned.

The number coding adjacent to each line in the decoder should help in visualising how the decoder operates. Note that the RL1 contact "gates" separate odd numbers from even, and that each set of contacts which follow progressively subdivides the possibilities. Only four inputs are required by the relay tree decoder, derived from the Y outputs of the flip-flops or other elements of the circuit supplying the four bits of code information.

The diagram of figure 3(b) shows part of a decoder using transistors in the tree configuration. The operation is very similar to that of the relay decoder, although the fact that one transistor is required for each AND function results

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	57-18	1800	5	9.00	4.50
	57-24	2400	5¾	11.70	5.85
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two transistors being required to nctionally replace each set of relay angeover contacts.

Each bit of the coded input signal rovides base bias to saturate approiate transistors in the tree. Thus the rst bit saturates either TR1 or TR2, epending upon its value; the second bit milarly saturates either TR3 and TR5 r TR4 and TR6, and so on. For each oded input number there will thus be n appropriate combination of saturated ansistors giving a current path through e tree.

It may be seen that transistor tree ecoder **grounds** the selected output conection rather than connecting it to power supply as did the relay decoder; might thus be called a "negative logic" ecoder. This change is dictated by the ating bias requirements of the transistor lements.

A complication arising in connection ith the gating bias is that later tranistors in the tree receive a progresively diminished gating input voltage as result of the voltage drop across arlier transistors. The reason for this that each transistor acts as an emitter eries impedance for those which suceed it.

Because of this complication the tranistor tree decoder is generally unsuitble for decoding information in the orm of large (i.e., many-bit) numbers. 'or four-bit BCD decade decoding it usually quite satisfactory, although tends to be somewhat costly comared with alternative systems. In pracice pure transistor tree decoders are arely used; more usually the tree aproach is used to simplify a basically arallel configuration.

Figure 3(c) shows part of a third type f tree decoder which is currently gainng in popularity by virtue of its rather nique combination of economy, simlicity and reliability. It is also very uitable for many of the fabrication echniques used in the manufacture of nicrocircuits.

As may be seen the circuit is rather imilar to that of the transistor decoder. The essential difference is that the AND lements are here photo-conductors. One nput to each photo-conductor is the pplied voltage derived from the fixed ower supply; the other is light received rom the associated lamp.

In darkness, each photo-conductor lement possesses a high resistance and asses negligible current; however when lluminated its resistance drops markedly nd it becomes capable of passing apreciable current. Because of the lamplement grouping, each coded input number results in the illumination of the orrect combination of elements to provide a low resistance path to the appropriate output terminal.

Although the lamps shown in the diagram are of the incandescent variety, almost any type of lamp is suitable; the choice of lamp type is dictated mainly by the type of drive circuitry available. Where sufficient drive voltage is available miniature neon lamps are often the most logical choice. Newer alternatives which are potentially better suited to microminiaturisation techniques are electroluminescent panels and light-emitting semiconductor junction diodes.

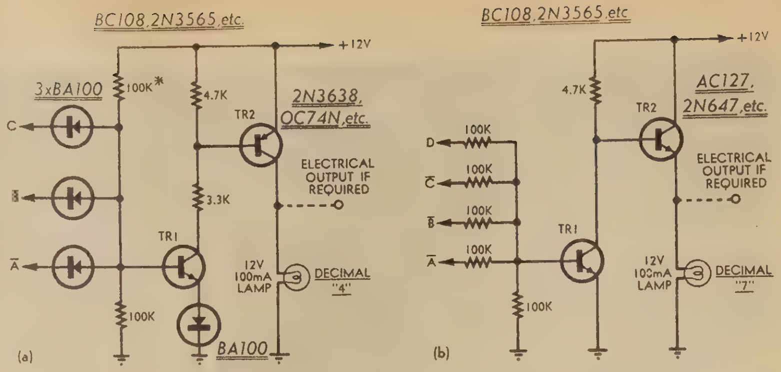
Let us now consider practical aspects of the parallel decoder configuration. As noted in connection with the diagrams of figure 2, this configuration is somewhat more flexible than the tree type in that it may be constructed using all types of combinational logic element — NAND and NOR elements are suitable as well as those for AND and OR.

While this means that there is an even larger range of potentially suitable logic devices and circuit elements than with the tree configuration, there are only two general circuits in common use. One uses diode gates to perform straightforward AND logic; the other uses resistor-transistor (RTL) gates to perform NOR logic on the complementary inputs. A sample stage from simple decoders of each type is shown in figure 4.

Diagram (a) shows the circuit for a complete diode logic AND stage to decode decimal "4" from 2421 BCD. It consists of the actual diode gate together with a two-transistor driver amplifier feeding a 12V 100mA readout lamp.

As shown the gate has three diode inputs, which connect to the code terms constituting the equivalent AND function for decimal "4" in 2421 BCD. However, if it is permissible to load the code sources slightly, one of the diodes may be replaced by the 100K resistor shown connecting to +12V. This leaves the logical operation unchanged but saves the cost of one diode.

The non-inverting driver amplifier which follows the gate was discussed in the preceding article of this series,

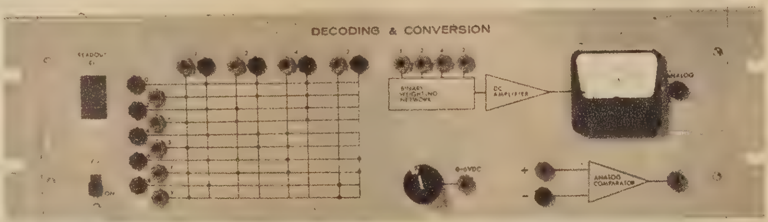


* MAY BE OMITTED IF PERMISSIBLE LOADING ON COUNTING REGISTER ALLOWS ONE INPUT DIODE TO BE REPLACED BY 100K RESISTOR

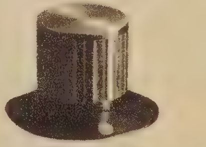
DIODE LOGIC "AND" DECODING STAGE FOR DECODING DECIMAL "4" FROM 2421 BCD

RTL "NOR" DECODING STAGE FOR DECODING DECIMAL "7" FROM 2421 BCD

Fig. 4



Shown here is the third panel from the author's "Digital Demonstrator" unit, to be described in the next article. The left-hand portion is a BCD-decimal decoder using circuitry as in (a) above.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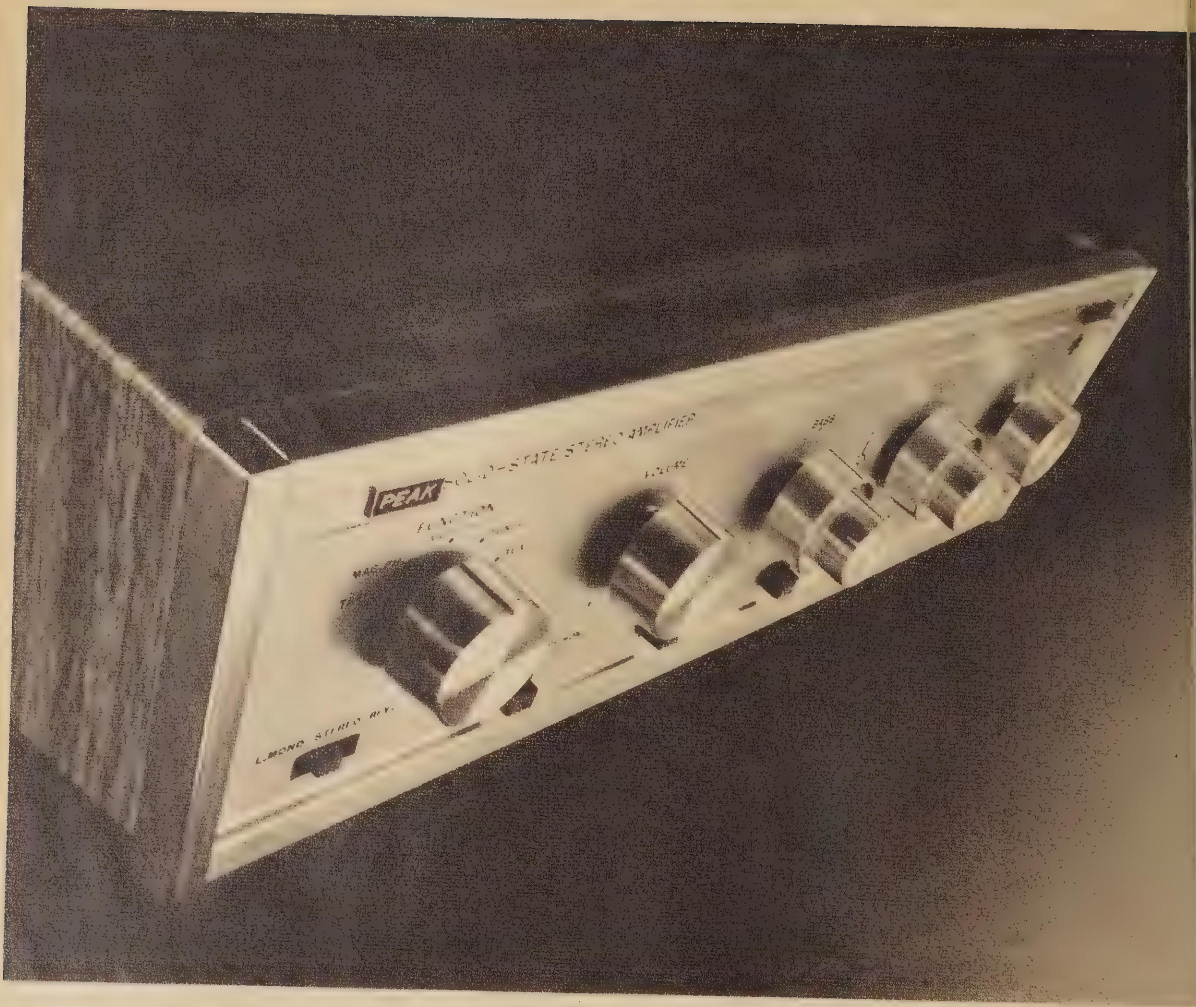
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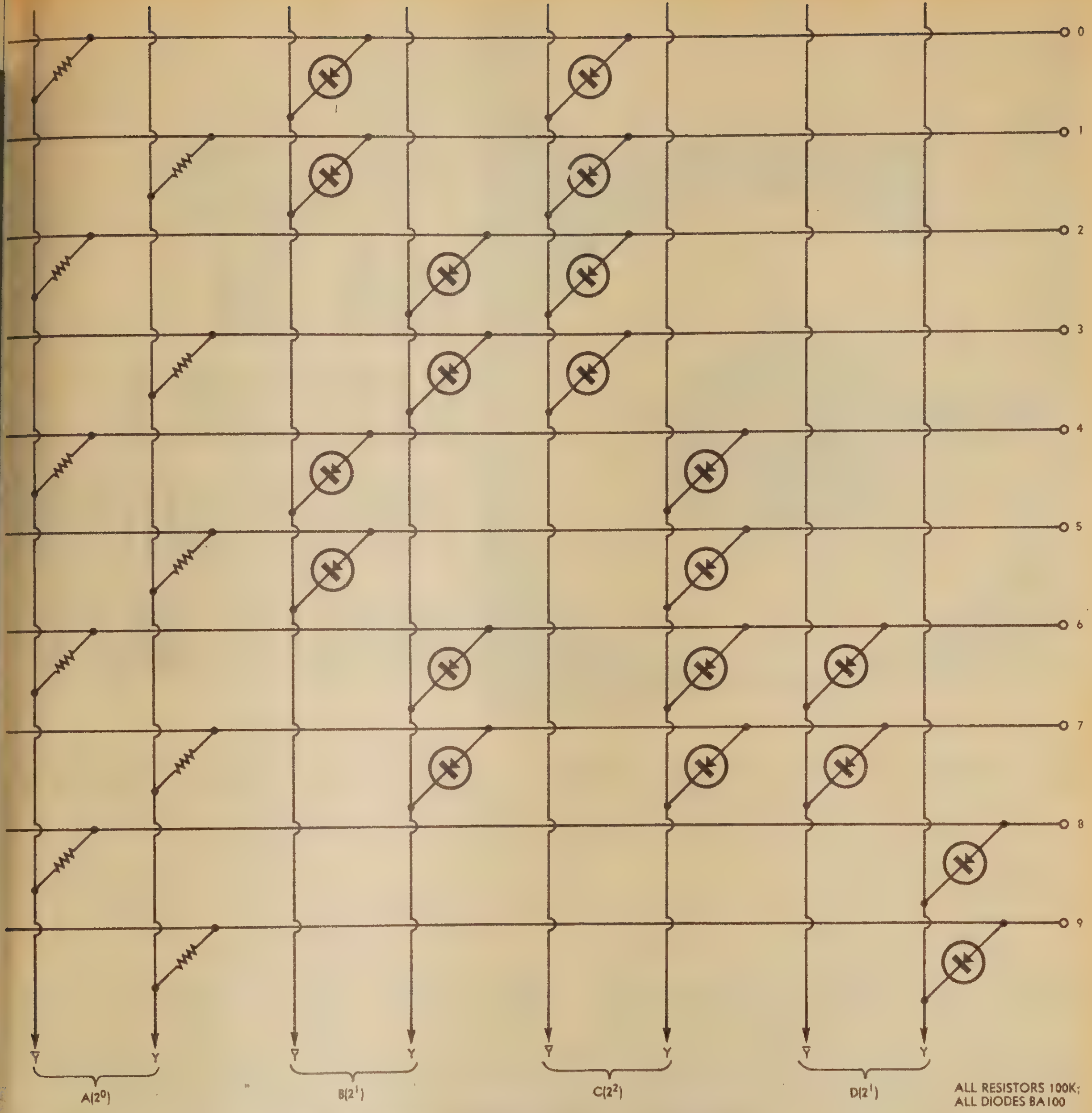

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Fig. 5

2421 BCD DECIMAL DECODING MATRIX ("AND" LOGIC)

and should need little further discussion here. The silicon diode in series with the emitter of transistor T1 provides the transistor with hold-off bias to ensure that it does not conduct unless all inputs are at logical "1" (=+9V). It is necessary because the code inputs do not in practice fall to 0V in the "0" state, but rather to a level representing the voltage drop across a saturated transistor.

The diagram of figure 4(b) shows for comparison the circuit for an RTL decoder stage. Here the stage is designed to decode 2421 BCD decimal "7," and has accordingly four inputs corresponding to the four terms of the NOR equivalent function (see figure 1).

The circuit may be recognised as differing only slightly from the NOR gate circuit given in the second article of this series. The input resistors perform an OR operation, transistor T1 performs inversion and transistor T2 provides current amplification to drive the indicator lamp.

In general, NOR parallel decoders are more attractive than AND decoders from a cost viewpoint, as they can use low-cost resistors in place of semi-conductor diodes. However where high-speed operation is required this advantage tends to disappear as the resistors must be shunted with compensating capacitors if the RTL circuit is to operate effectively.

Even at lower operating speeds the diode AND logic may prove more attractive, in that it lends itself somewhat more conveniently to a mixed parallel-tree configuration. Using such a mixed configuration with AND logic it is often possible to arrive at a more economical design than if a pure-parallel RTL configuration is used.

Unfortunately space limitations will not permit more than a brief reference to mixed configuration decoders at this point. However, an example of this type of decoder will be discussed shortly in connection with bi-quinary decoding.

Before this is done mention should be made of the common practice of conceiving and representing parallel BCD decoders using matrices.

In mathematics, when a relatively large number of terms have to be handled ed or processed or allowed to interact in a similar fashion, it often proves convenient to group them into a square or rectangular grid array which is called a matrix. By observing various conventions it is usually possible to treat the numbers far more easily and effectively as a matrix than individually.

The advantages to be gained from grouping things together as matrices are not peculiar to mathematics, however, and many other fields have accordingly "borrowed" the concept. In electronics it is finding increasing use as circuitry becomes more complex and repetitive; this particularly true in digital electronics.

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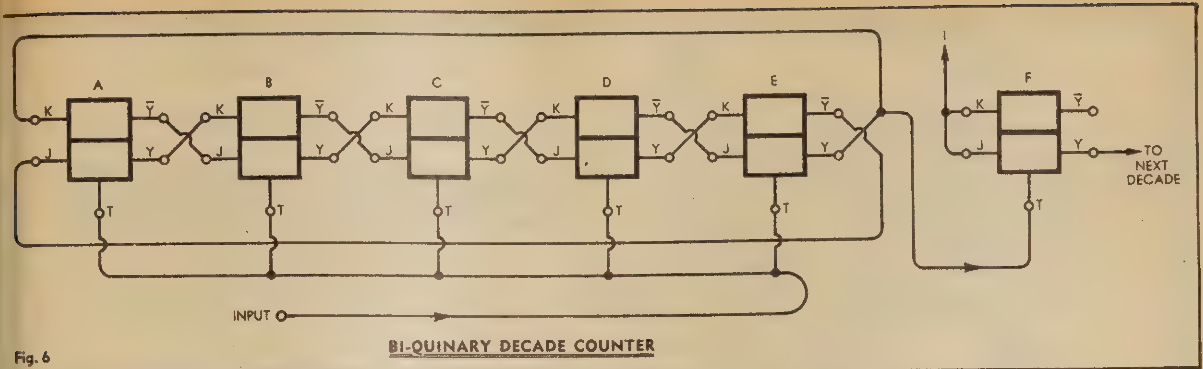


Fig. 6 **BI-QUINARY DECADE COUNTER**

A good example of the application of atrices in this field is that of the ferite core memory, where large numbers f tiny ferrite annuli ("doughnuts") are sed to store binary or BCD information. It proves most convenient both rom a fabrication and from a unctional viewpoint to group large umbers of the cores together as atrices—not only are they grouped toether compactly in a single frame, but is relatively easily arranged that they hare much of the required input and utput processing circuitry.

It is similarly advantageous to apply he matrix concept to parallel type BCD lecoders, grouping the decoder stages or all the output digits together as hown in figure 5.

The diagram shown is that for the lecoder panel shown in the photograph, orming part of the author's "digital denonstrator" unit. As may be seen it is imply the combination of ten AND tages of the type shown in figure 4(a). The resistor-diode substitution has been ncorporated for economy reasons, with he resistors used in each case for the 'A" or least-significant-bit (LSB) input.

Note that the matrix is used to group ogether only the actual decoding gates. The readout driver amplifiers thus become identical and are simply connected to each output terminal.

To conclude this discussion of decoding it may be worthwhile to give examples of decoders for non-BCD decimal codes. The first of these to be discussed is that for the bi-quinary (5 x 2) code.

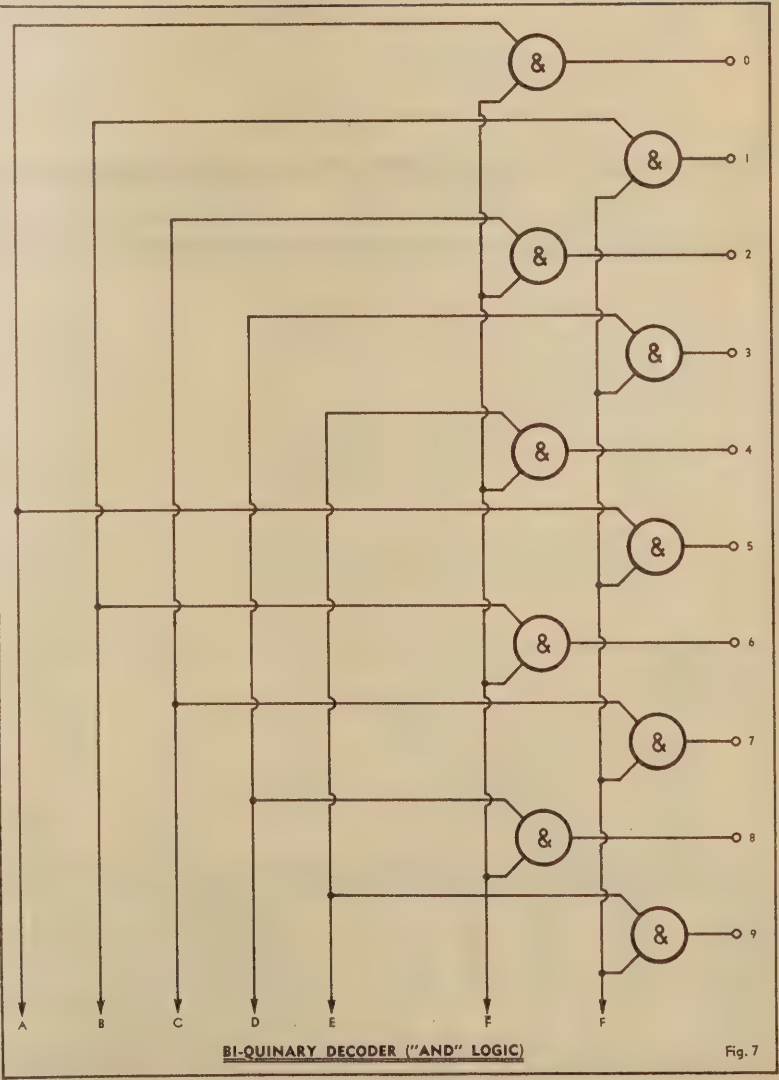
The diagram of figure 6 shows the basic logic of a bi-quinary counting decade using J-K flip-flop elements. Six elements are used in all, with five wired together as a normal ring counter and the remaining element following as a divide-by-two complementing stage.

As the first set of truth table columns shows, this combination of elements gives ten unique value-state combinations which correspond to the bi-quinary decimal code mentioned in earlier articles. Each combination consists of six value-states.

To decode the bi-quinary counter it is not necessary to sense all six value states of each combination. Close inspection reveals that only two value states are required to provide a sufficient definition for each decimal, as shown in the seventh data column.

As before there are various logic functions equivalent to the definition, corresponding to the various possible decoding logics. The AND and NOR functions are shown in the final column of the truth table.

DECIMAL	A	B	C	D	E	F	SUFFICIENT DEFINITION	EQUIVALENT FUNCTIONS
0	1	0	0	0	0	0	1----0	$A.\bar{F}$, $\overline{\bar{A}+F}$
1	0	1	0	0	0	0	-1---0	$B.\bar{F}$, $\overline{\bar{B}+F}$
2	0	0	1	0	0	0	--1--0	$C.\bar{F}$, $\overline{\bar{C}+F}$
3	0	0	0	1	0	0	---1-0	$D.\bar{F}$, $\overline{\bar{D}+F}$
4	0	0	0	0	1	0	----10	$E.\bar{F}$, $\overline{\bar{E}+F}$
5	1	0	0	0	0	1	1----1	$A.F$, $\overline{\bar{A}+\bar{F}}$
6	0	1	0	0	0	1	-1---1	$B.F$, $\overline{\bar{B}+\bar{F}}$
7	0	0	1	0	0	1	--1--1	$C.F$, $\overline{\bar{C}+\bar{F}}$
8	0	0	0	1	0	1	---1-1	$D.F$, $\overline{\bar{D}+\bar{F}}$
9	0	0	0	0	1	1	----11	$E.F$, $\overline{\bar{E} \mid \bar{F}}$



BI-QUINARY DECODER ("AND" LOGIC) Fig. 7

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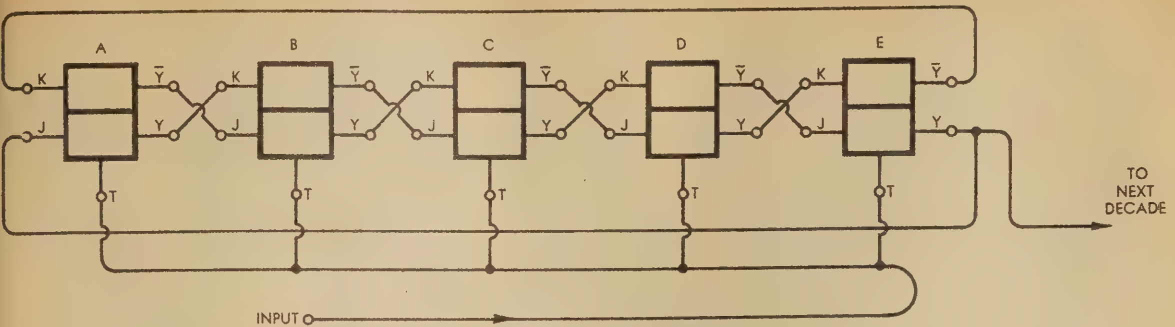

TWISTED-RING DECADE COUNTER

Fig. 8

Shown in figure 7 is the logic diagram for a bi-quinary decoder using the AND equivalent functions. Although a very simple decoder it may be seen to possess some of the features of both the tree and the parallel configurations, and might thus be regarded as of the "mixed" type.

Finally let us look briefly at a second example of non-BCD decoders: a decoder designed for the twisted-ring decade counter. The logic diagram and truth table for such a counter are shown in figure 8.

As we saw in an earlier article, the twisted-ring counter uses five bi-stable elements connected to form a ring possessing a single logical inversion. It provides the required ten unique value states with the important feature that only one element changes state upon the arrival of any input pulse. The latter feature makes it eminently suitable for high-speed counting and scaling.

Decoding the twisted-ring counter is as simple as with the bi-quinary counter. As with the latter, only two value states per combination are required to form the sufficient definition of the appropriate decimal digit. The sufficient definitions and corresponding AND and NOR equivalent functions are shown in the truth table.

Figure 9 shows a twisted-ring decoder using NOR logic. Here again while being a very simple decoder it is perhaps most conveniently regarded as of the "mixed" configuration type.

With this necessarily brief discussion of non-BCD decoders we must unfortunately draw the present article to a close. The next article in the series will present a discussion of digital-analog and analog-digital conversion, together with the description of the "decoding and conversion" panel of the author's digital demonstrator unit.

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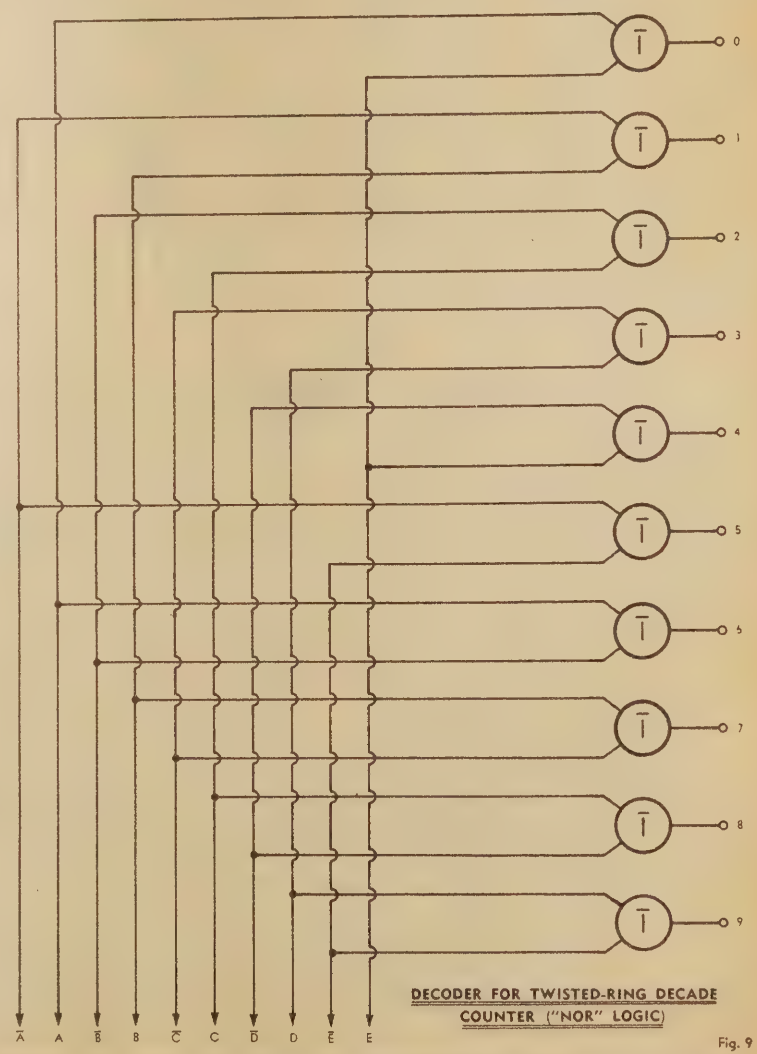
(To be Continued)

DECIMAL	A	B	C	D	E	SUFFICIENT DEFINITION	EQUIVALENT FUNCTIONS	
0	0	0	0	0	0	0–––0	$\bar{A}.\bar{E}$,	$\overline{A+E}$
1	1	0	0	0	0	10–––	$A.\bar{B}$,	$\overline{\bar{A}+B}$
2	1	1	0	0	0	–10––	$B.\bar{C}$,	$\overline{\bar{B}+C}$
3	1	1	1	0	0	––10–	$C.\bar{D}$,	$\overline{\bar{C}+D}$
4	1	1	1	1	0	–––10	$D.\bar{E}$,	$\overline{\bar{D}+E}$
5	1	1	1	1	1	1–––1	$A.E$,	$\overline{\bar{A}+\bar{E}}$
6	0	1	1	1	1	01–––	$\bar{A}.B$,	$\overline{A+\bar{B}}$
7	0	0	1	1	1	–01––	$\bar{B}.C$,	$\overline{B+\bar{C}}$
8	0	0	0	1	1	––01–	$\bar{C}.D$,	$\overline{C+\bar{D}}$
9	0	0	0	0	1	–––01	$\bar{D}.E$,	$\overline{D+\bar{E}}$



DECODER FOR TWISTED-RING DECADE COUNTER ("NOR" LOGIC)

Fig. 9

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LOUDSPEAKERS FOR THE STEREO P.A. SYSTEM

This is the story of a loudspeaker system which started out as a rather novel line-source unit for public address and finished up with specifications which put it into the category of a higher-powered version of our highly successful "Bookshelf" system.

By W. N. Williams

The general concept of this new loudpeaker system was mentioned in last month's article on the "Stereo Public Address Amplifier" but, at the time, we ad not completed our developmental work on the system, nor realised how ompletely successful it would be.

To start at the beginning, the new system has its roots in the 36-inch tall ne-source enclosure, which was des- ribed in December 1961, for use with ndoor public address systems. We tend- d to think of them in those days as column" speakers, but the term invited so much confusion with the quite un- elated idea of mounting domestic hi-fi peakers in drain pipes or other columnar structures.

A line source system is one in which, ypically, four or more loudspeakers are mounted fairly close together and in a ertical line. The cones face the area o be served with sound, the rear of he loudspeakers usually being enclosed.

Provided the loudspeakers are connected so that the cones move in phase, hey tend to project a beam of sound which has a fairly wide coverage in the horizontal plane, but a fairly narrow beam in the vertical plane.

The unit is normally mounted in an auditorium so that it is above the heads of people seated in the front rows and aimed toward those at the rear. People at he front of the auditorium receive only a limited proportion of the sound, because the beam tends to pass above them, while those at the rear, who most need it, receive the full benefit of the reinforcement.

The system has the additional advantage that the main beam of sound is kept out of the ceiling area in lofty auditoriums, thus inhibiting the generation of strong echoes from this area.

The original line source enclosure was arranged to be 36 inches tall, mainly because this is a convenient figure for home carpenters working with a standard sheet of plywood. The remaining dimensions represented a compromise between an enclosure which would not be unduly bulky, and one which would not generate a too prominent peak in the upper bass register, because of an unduly small enclosed volume.

In an effort to relieve and utilise back pressure from the cones, we suggested drilling a pattern of small holes down both sides of the baffle, forming what is commonly referred to as a "distributed port."

For the loudspeakers we suggested four Magnavox 6WR twin-cone units, normally connected in series-parallel to give the same impedance as a single unit. For those who might have been deterred by the price of the 6WR we suggested using its "smaller-muscled" brother, the 6PIX. In fact, other 6-inch loudspeakers have since made their appearance on the market, with a sufficiently low bass resonance (50 to 60Hz) and adequate power handling and frequency response to do a similar job.

While a line source loudspeaker system along these general lines remains as good a proposition as ever for indoor public address, we were deterred, as we explained last month, by the thought that few would be prepared to provide two such systems for our proposed Stereo Public Address amplifier. We had to find a more appealing answer.

This led to the idea of making two enclosures, each about 18 inches tall and each containing two 6-inch loudspeakers. Where the situation demanded a line source system, for its vertical

Two of the new enclosures arranged at right make an excellent 4-speaker line source system. Alternatively, they may be used with last month's amplifier to constitute a pair for good quality stereo music. The internal loudspeaker complement can be varied to minimise expense or to achieve what is virtually a higher-powered equivalent of our popular Playmaster "Bookshelf" system. They could, in fact, become firmly established in the quality market, purely on this latest consideration.

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＊ SPEAKER SYSTEM SS-30
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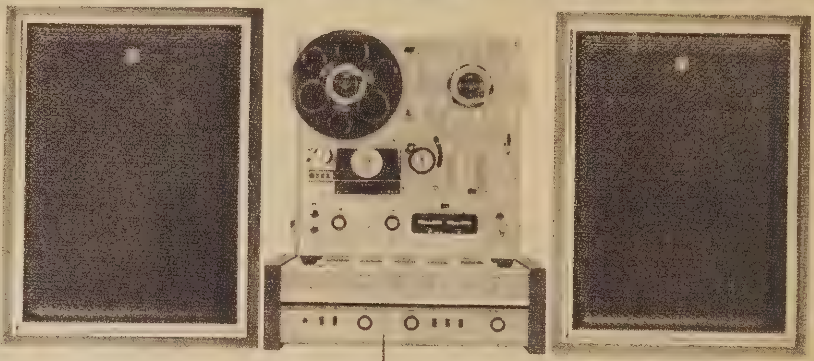
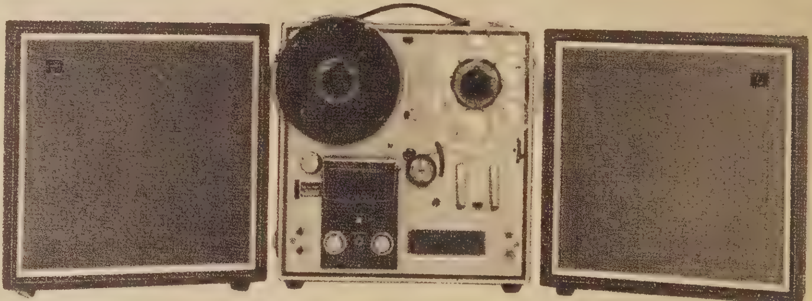


MODEL X-100D
MODEL AA-5000

SW-130



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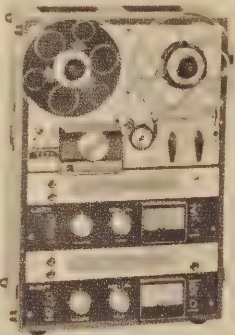
SS-30



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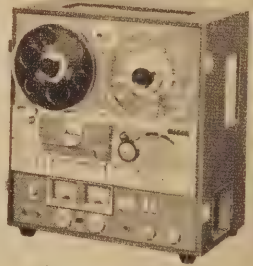

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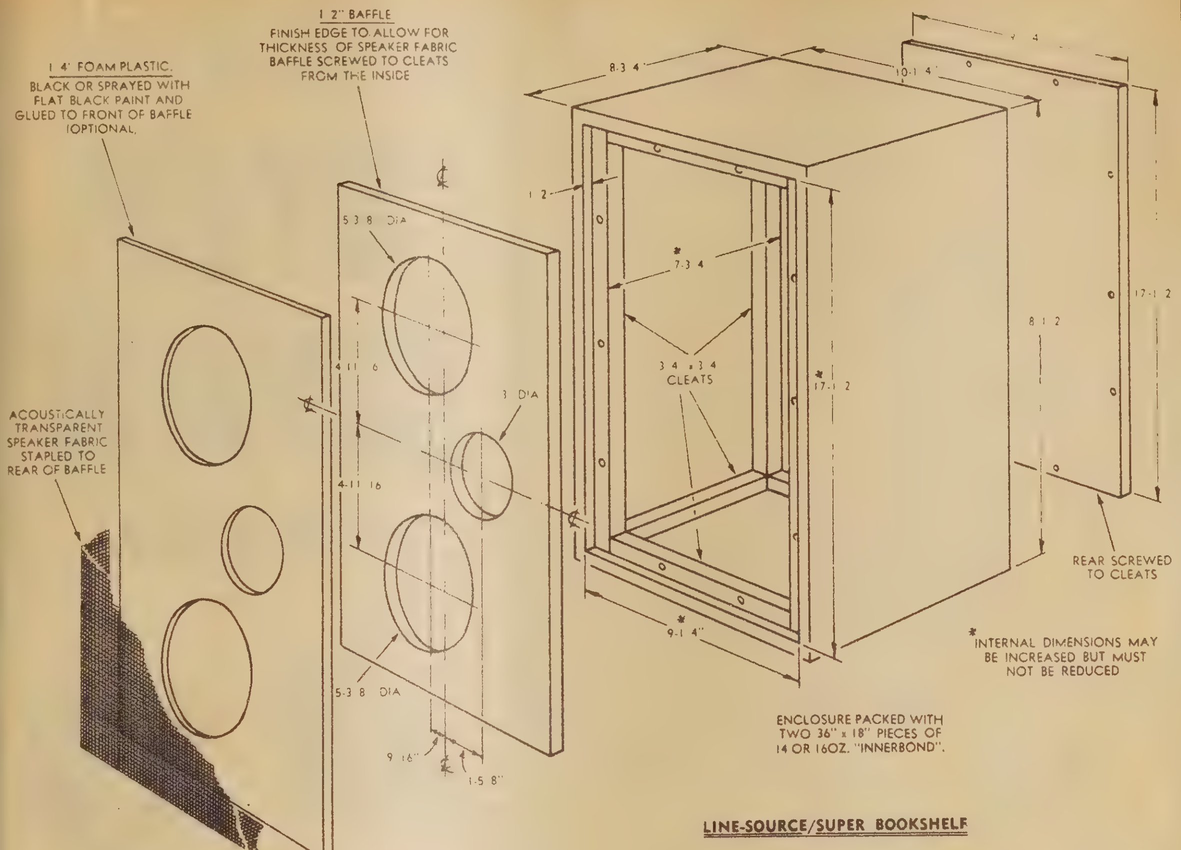
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LINE-SOURCE/SUPER BOOKSHELF

The exploded diagram shows the construction of the new enclosure, together with essential internal dimensions. These can be varied slightly provided internal volume is not reduced. Minimum wall thickness is ¼-inch and all joints should be airtight. The foam overlay for the baffle is purely for styling and was not fitted to the prototype cabinets.

lirectivity, the enclosures could simply e stood one on top of the other, to roduce a 36-inch 4-speaker column ery similar to the original.

However, where the opportunity ccurred, the enclosures could be separated, typically one to either side of a stage, to provice stereo music and well lispersed speech from the microphone hannel. Each would have some vertical directivity, by reason of the two vertically aligned cones.

As we implied last month, the idea fitted the need so well that to think of it was to adopt it!

When we began to examine the proposition more closely, it became apparent that the proposed twin enclosures had the potential of being more than just the two halves of a public address line source. They would be of such a shape and size that they might very well be expected to double as compact enclosures for a high quality domestic stereo set-up. In planning them, therefore, we took a critical look at dimensions and volume, at the possibility of retaining our original distributed port idea, at the mailing-tube type of port and at the possibility of providing room for a tweeter and even a cross-over network!

Why design an enclosure for just one job, we reasoned, if we could make it readily adaptable for several?

To cut a long story short, first-off we dropped the idea of the distributed port. Whatever advantages the scheme might have, it is quite unsuitable for economical mass production by cabinetmakers —remembering that most people now

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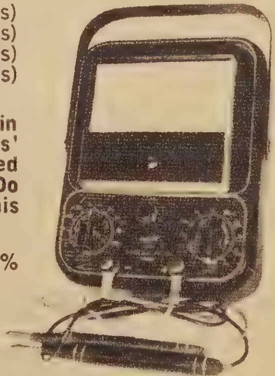

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		SOLDERING IRON TRANSFORMER	
TS3.3/60	240	3 3V—60 Volt amperes cont.	Two
	ECONOMY RANGE	6V STEPDOWN TRANSFORMERS Enclosed in pressed Steel covers	2-PIN POLARISED SOCKET
TS6/30	240	6V—30 Volt amperes	One
TS6/60	240	6V—60 Volt amperes	One
		FUSE MASTER RANGE STEEL CASE TYPE.	
TS6/60A	240	6V—60 Volt amperes	One
	ECONOMY RANGE	12V STEPDOWN TRANSFORMERS Enclosed in Pressed Steel Covers	2 PIN POLARISED SOCKET
TS12/12	240	4, 8, and 12V—12 Volt amperes	3 Terminals
TS12/30	240	12V—30 Volt amperes	One
TS12/60	240	12V—60 Volt amperes	One
TS12/100	240	12V—100 Volt amperes	One
		FUSE MASTER RANGE STEEL CASE TYPE	
TS12/30A	240	12V—30 Volt amperes	One
TS12/60A	240	12V—60 Volt amperes	One
TS12/125A	240	12V—125 Volt amperes	Two
	ECONOMY RANGE	24V STEPDOWN TRANSFORMERS Enclosed in Pressed Steel Covers	2-PIN POLARISED SOCKET
TS24/30	240	24V—30 Volt amperes	
TS24/60	240	24V—60 Volt amperes	One
TS24/100	240	24V—100 Volt amperes	One
TS24/200	240	24V—200 Volt amperes	One
		FUSE MASTER RANGE STEEL CASE TYPE	
TS24/30A	240	24V—30 Volt amperes	One
TS24/60A	240	24V—60 Volt amperes	One
TS24/125A	240	24V—125 Volt amperes	Two
TS24/200A	240	24V—200 Volt amperes	Two
TS24/500A	240	24V—500 Volt amperes	Two
	ECONOMY RANGE	32V STEPDOWN TRANSFORMERS Enclosed in Pressed Steel Covers	2 PIN POLARISED SOCKET
TS32/30	240	32V—30 Volt amperes	One
TS32/60	240	32V—60 Volt amperes	One
TS32/125	240	32V—125 Volt amperes	One
TS32/200	240	32V—200 Volt amperes	
		FUSE MASTER RANGE STEEL CASE TYPE	
TS32/30A	240	32V—30 Volt amperes	One
TS32/60A	240	32V—60 Volt amperes	One
TS32/125A	240	32V—125 Volt amperes	Two
TS32/200A	240	32V—200 Volt amperes	Two
TS32/500A	240	32V—500 Volt amperes	Two
TS32/750A	240	32V—750 Volt amperes	Two
TS32/1000A	240	32V—1000 Volt amperes	Two
	ECONOMY RANGE	115V STEPDOWN TRANSFORMERS Enclosed in Pressed Steel Covers	2 PIN SOCKET FLAT
TS115/30	240	115V—30 Volt amperes	One
TS115/60	240	115V—60 Volt amperes	One
TS115/100	240	115V—100 Volt amperes	One
TS115/150	240	115V—150 Volt amperes	One
TS115/200	240	115V—200 Volt amperes	One
TS115/300	240	115V—300 Volt amperes	One
		FUSE MASTER RANGE STEEL CASE TYPE	
TS115/30A	240	115V—30 Volt amperes	One
TS115/60A	240	115V—60 Volt amperes	One
TS115/125A	240	115V—125 Volt amperes	One
TS115/200A	240	115V—200 Volt amperes	One
TS115/500A	240	115V—500 Volt amperes	One
TS115/750A	240	115V—750 Volt amperes	One
TS115/1000A	240	115V—1000 Volt amperes	One
TS115/2000A	240	115V—2000 Volt amperes	Two

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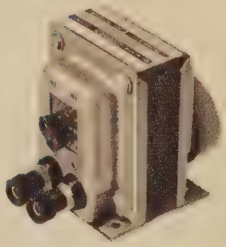

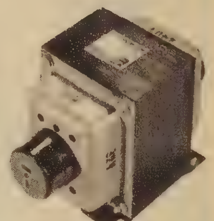

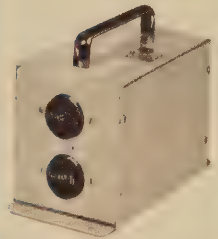

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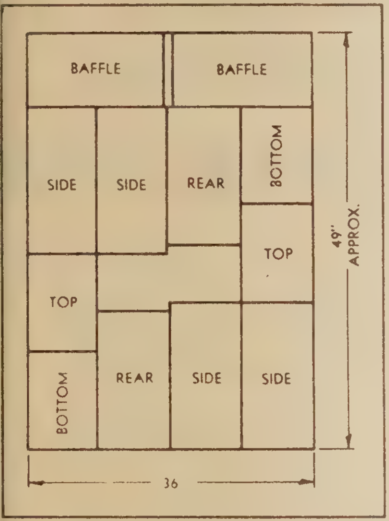
ny cabinets or kits. A home carpenter may find time to drill a hundred or so oles in a baffle, but not a cabinet or t maker trying to achieve a certain roduction rate. Nor could we find a eady supply of pre-punched material hick enough for a baffle.

The mailing-tube type of vent is much more practical but we were not happy ith results, considering the relatively mall cabinet volume. The system tended o frequency double at the low end more han we liked, while the cloth across he port mouth added its own considerble quota of flap and buzz.

So we reverted to what we had found o successful with the Playmaster Bookhelf unit: a completely airtight enlosure substantially filled with Innerond material, to lower and to damp he system resonance.

With the dimensions as shown, the ystem resonance with 6WR loudspeakrs, occurs at about 90Hz, which is just trifle higher than the original Bookhelf. However, thanks to the heavy damping provided by the Innerbond and by the average modern amplifier, there is virtually no sign of the resonance in the sound pressure curve; actually, we kept track of it by metering voice coil current. The actual pressure curve taken with the enclosure at floor level, is well-sustained to about 70Hz, where the bass roll-off becomes evident.

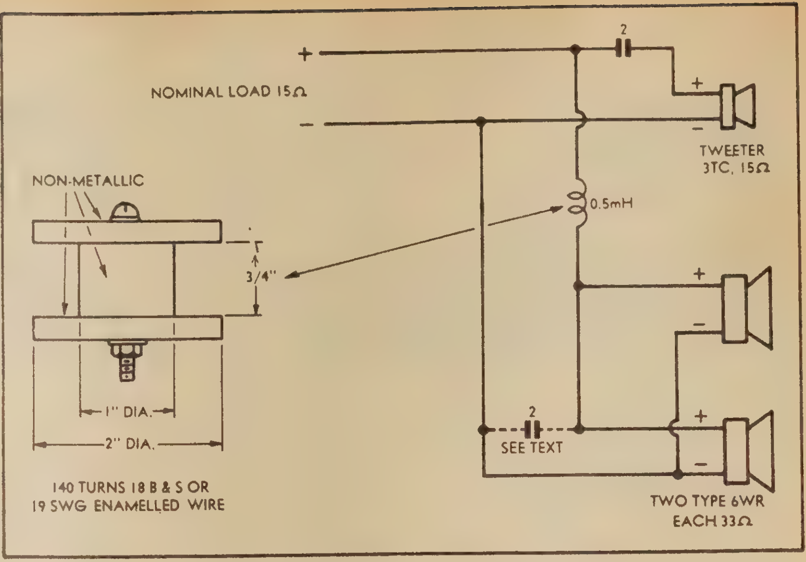


For those working with plywood sheets, the cabinets can be cut out as shown, for minimum wastage.

Not having to provide for port area cleared the way for possible addition of a 3-inch (or smaller) tweeter, the 6-inch loudspeakers being moved to one side just enough to create room for it.

We therefore set about a series of listening and evaluation tests on the basis of a sealed enclosure, to be packed with an amount of Innerbond yet to be verified, and with room to mount a tweeter and cross-over network, should these be considered worthwhile.

In accordance with the advice of Magnavox engineers, the 6WR loudspeakers in the new cabinet were two 33-ohm units wired in parallel to give near enough to the usual 15 ohms impedance. The parallel connection puts each loudspeaker directly across the amplifier, independently of other speakers. With any kind of a series arrangement, inevitable variations in the impedance of one speaker affect the drive to the other and, of course, the electrical damping.



The diagram at the right shows how the system is wired internally and, at left, winding details of the inductor. A suitable inductor may be made available commercially. The extra 2uF capacitor shown dotted improved the response contour around 5KHz. Without it, the system has a slightly more "middly" sound, which some may actually prefer.

Our advice, therefore is to plan for the loudspeakers to be connected in parallel and to order units which will give the requisite total impedance.

Our first observations were made with just the two 6WR loudspeakers in the enclosure, and with the tweeter cutout blocked off. As some kind of a reference, we set it up alongside one of our prototype Playmaster "Bookshelf" units, for which we had measured curves, with a changeover switch to select one or the other.

With just the two 6WR's in operation, the general sound quality was good and certainly well above average by any kind of public address standards. The bass had a good "fundamental" sound about it and we have no hesitation in recommending the use of two such enclosures, as originally envisaged, each containing a pair of 6WR's. For the loss of about 2dB in sensitivity and a somewhat lower maximum acoustic output, the cheaper 6PIX loudspeakers could be used.

Other low resonance high-performance loudspeakers might also be considered as alternatives for this general role, provided they can be obtained with a suitable voice coil impedance.

As for the Innerbond packing, it is quite practicable to use the same size piece as suggested for the Playmaster Bookshelf enclosure (14 or 16oz, 36 x 18 inches) loosely rolled to occupy the space behind the speakers. If the cost is no deterrent, up to double this amount can be used, though not with too much audible effect on performance.

Objective number 1 had been achieved and verified. We could recommend a loudspeaker system which could double either as a line source unit or a stereo pair of better than average quality for domestic listening.

Then we surrendered to the seemingly irresistible urge to see just how far this same enclosure could be exploited, in the pursuit of quality.

Comparison with the Playmaster Bookshelf system showed the new unit to be lacking in the upper register, judged by high fidelity standards; this despite the 6WR's tweeter cone.

At this stage, we uncovered the third hole in the baffle and installed the Magnavox 3TC3-inch tweeter. Taking care to observe correct polarity, one side was wired directly to the equivalent lug of the parallel connected 6WR's, the other side of the tweeter being fed from the active input via a 2uF capacitor.

Introduction of the tweeter brightened up the response quite a lot but, remembering the lessons learned from the Bookshelf system, we decided not to jeopardise results by leaving out the inductor necessary to constitute a proper cross-over network. A 0.5mH coil was then added, providing a cross-over at 5KHz, to suit the small tweeter.

Now on listening test, the system sounded quite impressive and, at loud volume, there could be no doubt about the value of having two 6WR speakers to share the heavy work up to 5KHz. Listening and measured tests indicated, also, the desirability of completely filling the enclosure with Innerbond, amounting to two pieces of 14 or 16oz material, each 36 x 18 inches rolled together to tuck fairly tightly around the speakers.

Under these conditions and with about half bass boost from a twin 12-watt amplifier, the bass response assumed a heavy non-resonant quality, that seemed completely free of doubling or distress of any kind.

Overall, the sound had a slightly middle-heavy quality, so favoured by some for its "presence" and so "safe" by reason of its discrimination against any slight "edge," whether present in the original music or produced by less than perfect record and replay. But most observers in the E. A. lab. still expressed a preference for the somewhat brighter sound of the Bookshelf unit.

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licated the reason clearly enough. While the tweeter was doing its duty high up, the 6WR's were letting down a little in the 5KHz region by comparison with the level elsewhere.

The answer turned out to be delightfully simple: Add a further 2uF capacitor, this time wired across the 6WR's. By turning this half of the filter into a quarter-section, it would lift the output from the 6WR's near the cross-over region, dropping it away more sharply where the tweeter took up.

The modification left no doubt, either in the response configuration or listener verdict: The new system sounded every bit as good as the Bookshelf in terms of balance and remained clean at higher power levels where the Bookshelf, with its single bass speaker, was showing signs of distress.

In short, having started out to develop a public address unit, we had ended up with a loudspeaker system which we are quite happy to identify as the Playmaster "Super Bookshelf."

The "Super" is not intended to supersede the original Bookshelf unit and the performance of the two will leave little to choose at ordinary domestic listening levels. But, if you want higher power handling capacity and are prepared to meet the extra outlay for the additional bass speaker, the extra capacitor and the extra Innerbond, a Super Bookshelf will take a lot of beating, both in terms of performance and value.

And, of course, a pair can still be treated as the two halves of a superb line source system!

Having explained at such length how the new unit came into being, we must not overlook the few paragraphs necessary to discuss construction.

The exploded diagram herewith gives the essential inside dimensions and suggests a typical arrangement of internal cleats to hold it all firmly together. The dimensions can be varied somewhat to suit individual needs provided the internal volume is not decreased. It may be increased but NOT decreased.

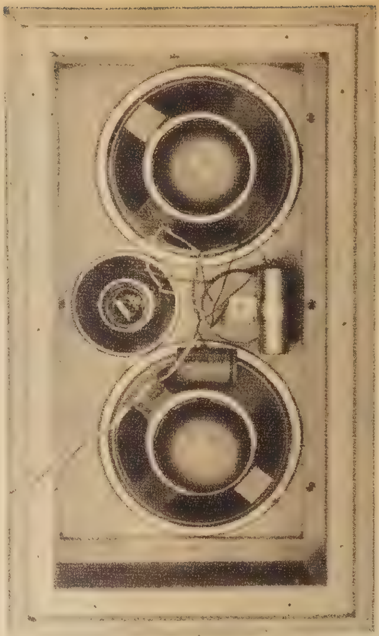
With the relatively small panel sizes involved in the enclosure, half-inch thick material is adequate. It may be made thicker but NOT thinner.

Home carpenters may prefer to work with plywood but those mass-producing cabinets, these days, seem to prefer flake board of one type or another. This is quite satisfactory, provided you don't expect to wind screws in and out the same holes too many times. The original cabinets were actually made for us out of flake board, surface finished in oiled teak veneer. As such, their appearance was much more appropriate to a modern loungeroom than a P.A. situation, where a plastic cloth or laminate would probably be more the thing.

A basic requirement of sealed enclosures is that they should, in fact, be airtight, in the acoustic sense of the term. Joints at the four corners should be snugly glued, and all cleats accurately fitted and glued in position. If the front baffle and back are dressed to a snug push-fit, a pattern of screws around the cleats should hold them firmly in place.

And don't spoil all the good work by just passing the leads out through oversize holes. Fit connectors or plug the holes with a non-hardening compound.

The connection of the loudspeakers and details of the inductor are given in the accompanying diagrams. Note that, with the 3-inch or other small equivalent tweeter, the cross over MUST be in the vicinity of 5KHz and not 2.5KHz, as preferred in the original Bookshelf unit, with 5-inch tweeter. The indicator therefore must NOT be a 1.0mH unit but one having 0.7 the number of turns and half the inductance.



The arrangement of components inside the enclosure for the full-scale "Super Bookshelf" version. Note that the loudspeakers are bolted in for strength, rather than relying on screws.

The 2uF capacitors are not critical as regards type or specification, as long as they are paper types and somewhere near the requisite value, as checked on an R/C bridge. The voltage rating is unimportant.

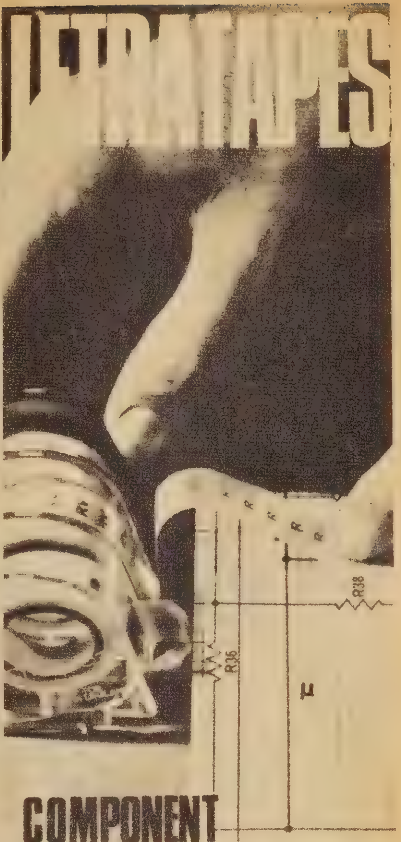
The unit, as described, is based on a nominal 15-ohm impedance, which will meet most requirements.

To construct a nominal 8-ohm version of the unit, it would be necessary to use two parallel connected 15-ohm 6WR loudspeakers and to associate them with an 8-ohm tweeter. The capacitor value would have to be increased to 4uF and the inductor reduced to 0.25mH, having about 0.7 the number of turns of the 0.5mH inductor.

Perhaps we can forestall another question: If the new enclosure appeals, with its somewhat more "dumpy" shape, can it be used to house a Bookshelf system?

Yes, we thought of that one too. Its internal volume is higher than that of the Bookshelf and a single 6WR operating in it would acquire a slightly lower system resonance, which is all to the good. Mount one 6WR at the bottom, fit a masonite or plywood patch over the two remaining holes and mount the tweeter of your choice on it so that it radiates out through the upper hole. Keep the whole system airtight, and use a single 36 x 18-inch piece of Innerbond, as for the Bookshelf unit.

If your choice is for a 5-inch tweeter, provide a 2.5KHz crossover; if it is a smaller type, provide a 5KHz crossover. ■



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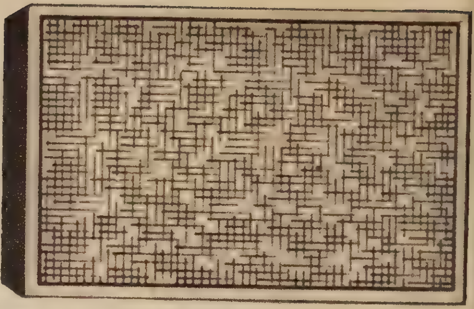

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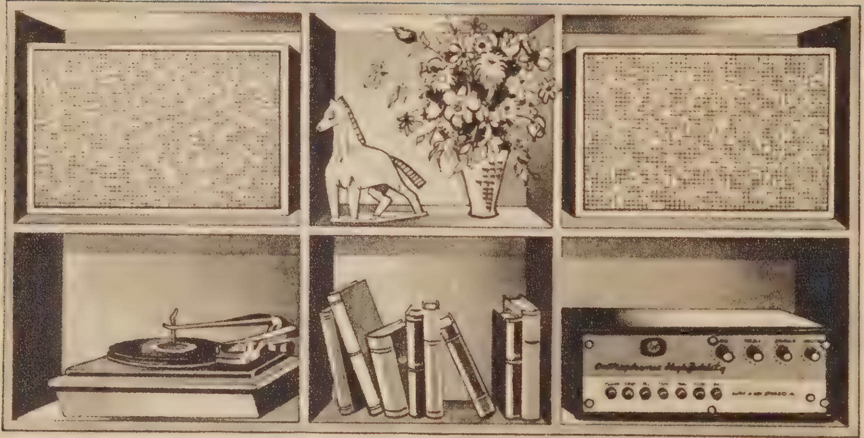

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by Jamieson Rowe and Keith Woodward

The "Auto-Dim" unit described in this article acts rather like a "third hand" in situations where the mains supply to a bank of lamps or a heater must be turned up and down. Once the operator has turned the appropriate knob, the unit takes over and performs the desired fast or slow glide smoothly and automatically.

With the component values shown in the basic circuit the dimming time is adjustable from about one to fifty seconds. However by altering the value of one of the components the maximum time may be extended to more than ten minutes with some reduction in setting convenience for the shorter times. A fixed maximum dimming time of approximately 30 minutes is also available, although only for "downward" dimming.

With the more restricted time range the dimming time is easily adjusted to produce the slow "fade-up" and "fade-down" of house-lights so essential for a polished and professional theatrical presentation. Further features which make it eminently suitable for such applications are the provision for emergency "fast on", and the provision of an adjustable intermediate level between full-on and full-off. The latter is ideal for providing a "twilight" condition until the audience has settled into its seats.

Apart from its fairly obvious applications in movie, slide-show and live theatre work, both for house-light and special-effects dimming, the unit should also find many uses in other fields where lamps or heaters must be dimmed smoothly and/or slowly.

One likely application which suggests itself is for the control of a night-light for children who tend to be afraid of the dark. With the unit modified for maximum dimming time, the night-light will be dimmed smoothly and imperceptably over a period of 30 minutes — after which period the child is usually asleep, having been gently and subtly relaxed by the artificial "sunset" effect.

Other possible applications are in photographic studios, both "still" and movie, for producing special lighting effects; in industrial processes, where heat or light must be applied and removed at a controlled rate; and in applications where expensive lamps must be operated on a "soft start" basis to minimise surge failure and prolong life.

Aside from such "direct" applications of the unit as described, there may be applications for the **high-gain power amplifier** which forms its greater part. As this section of the unit requires a DC input of but a few microamps to control AC output currents of up to 10 amps RMS, it might well form the basis of an economical high-power AC function generator or servo amplifier, or perhaps a high-power regulated DC supply.

Enough of such speculation, however; surely sufficient has been said to more than justify the appearance of the design and this article. Let us now pass on to a discussion of the operation of the unit.

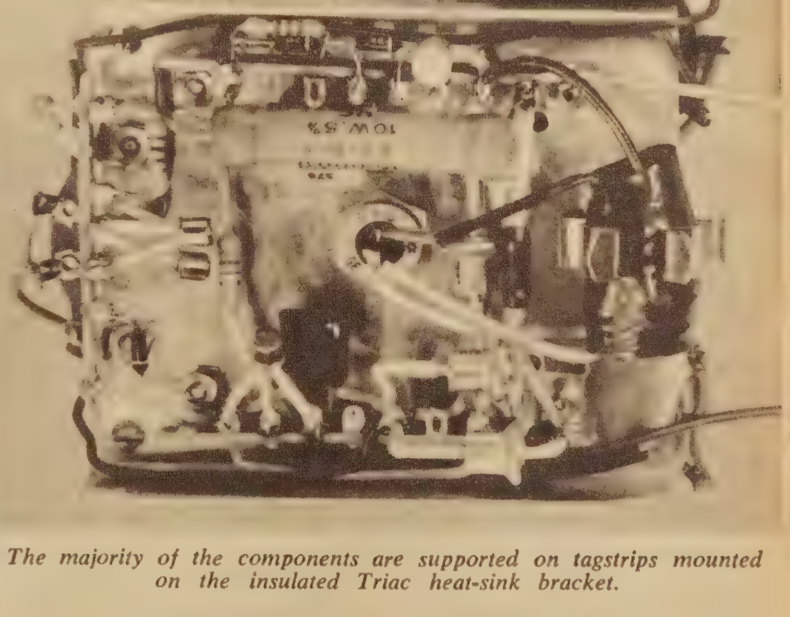
At the heart of the design is a "Triac" silicon AC control device, a recent development by General Electric of U.S.A. and a close relative of the thyristor or "SCR". This is the same device which we used in the "Variwatt" manual dimmer unit described in the January 1966 issue of "ELECTRONICS Australia."

For a fairly detailed description of the Triac and its principles of operation readers are referred to either the above article or to the "Keeping Up With Semiconductors" article of last month. However for the following discussion it may be sufficient to visualise the Triac as virtually two thyristors in inverse parallel, sharing a common gate electrode and a common case.

Like the Vari-watt, the Auto-Dim circuit employs phase control to vary the conduction of the Triac for each half-cycle of the AC supply. However, whereas the Vari-watt uses a simple R-C phase shift circuit and silicon breakover diode to produce the required adjustable-phase trigger pulses, the Auto-Dim uses a unijunction transistor relaxation oscillator coupled to the Triac via a small pulse transformer. The unijunction may be a G-E economy type 2N2646, a type 2N2160 or similar.

The operation of the circuit is as follows: The Triac is connected directly in series with the load socket across the mains. Also across the mains is a bridge rectifier circuit using four 400V rating silicon diodes; the output of this bridge therefore consists of unidirectional pulses of 340V peak amplitude (240 x 1.414), corresponding to the half-cycles of the input AC.

A regulator-clipper circuit connected across the rectifier output is used to produce a clipped version of this pulse voltage, to operate the low-voltage transistor circuitry. The regulator consists of a 15K 10W resistor series arm and



The majority of the components are supported on tagstrips mounted on the insulated Triac heat-sink bracket.

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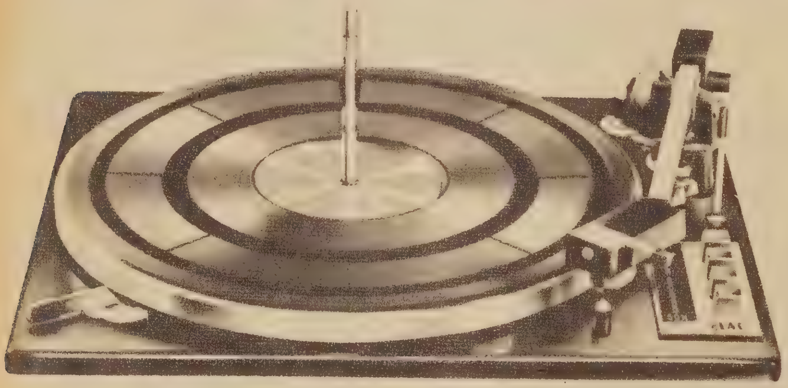

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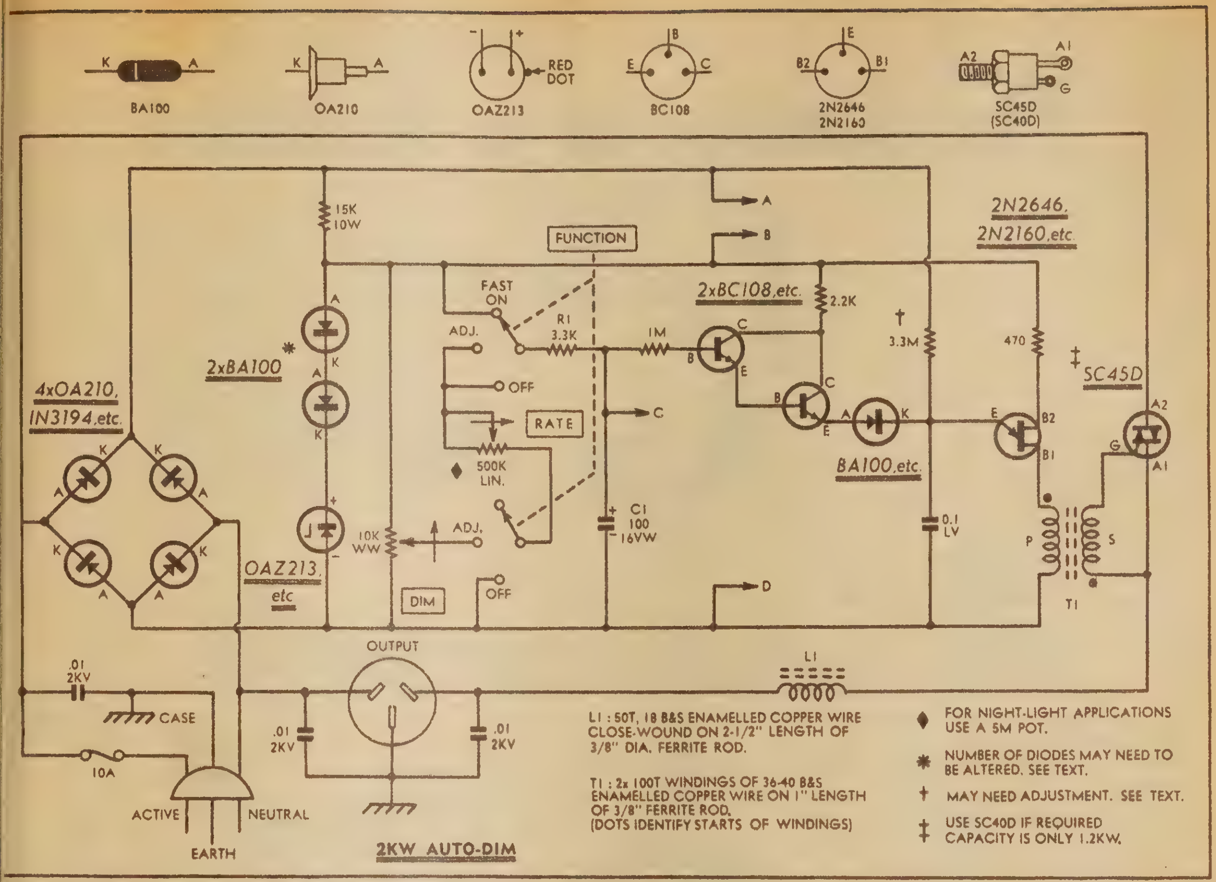
K
A
BA100
K
A
OA210
RED DOT
OAZ213
B
E
C
BC108
E
B2
B1
2N2646
2N2160
A2
A1
G
SC45D
(SC40D)
A
B
15K
10W
FUNCTION
FAST ON
ADJ.
R1
3.3K
1M
OFF
2xBC108,etc.
2.2K
3.3M
470
2N2646,
2N2160,etc.
SC45D
2xBA100
4xOA210,
IN3194,etc.
RATE
500K
LIN.
C
BA100,etc.
C1
100
16VW
0.1
LV
P
S
T1
10K
WW
ADJ.
OAZ213,
etc
DIM
OFF
D
OUTPUT
L1
.01
2KV
CASE
10A
ACTIVE
NEUTRAL
EARTH
2KW AUTO-DIM
L1 : 50T, 18 B&S ENAMELLED COPPER WIRE CLOSE-WOUND ON 2-1/2" LENGTH OF 3/8" DIA. FERRITE ROD.
T1 : 2x 100T WINDINGS OF 36-40 B&S ENAMELLED COPPER WIRE ON 1" LENGTH OF 3/8" FERRITE ROD. (DOTS IDENTIFY STARTS OF WINDINGS)
◆ FOR NIGHT-LIGHT APPLICATIONS USE A 5M POT.
* NUMBER OF DIODES MAY NEED TO BE ALTERED. SEE TEXT.
† MAY NEED ADJUSTMENT. SEE TEXT.
‡ USE SC40D IF REQUIRED CAPACITY IS ONLY 1.2KW.

The circuit of the unit. The high-gain power amplifier section may also find use in other applications, as suggested in the text.

a shunt arm comprising a nominal 12V zener diode (OAZ213 or similar) in series with approximately two forward-biased silicon diodes (BA100 or similar).

The principal function of the forward-biased silicon diodes is to allow convenient adjustment of the transistor supply voltage, which in turn controls the maximum obtainable output power in a manner to be explained shortly. The exact number of diodes required thus depends upon within-tolerance variations in other components.

A secondary function of the diodes is to provide temperature compensation for the voltage regulator. As forward-biased semi-conductor diodes have a negative temperature coefficient, they tend to counter the positive temperature coefficient of the zener diode.

The nominal 13V peak clipped output of the regulator is used as the supply voltage for the unijunction transistor. It is also used as the supply for a cascaded-emitter-follower or "Darlington pair" transistor amplifier using two silicon planar NPN transistors (type BC108, 2N3565 or similar), whose purpose has yet to be explained. And finally, it is used to provide a source of charging current for the 100uF capacitor marked C1.

In addition to the regulator-clipper circuit connected across the bridge rectifier output there is a 3.3M resistor, connecting to the unijunction emitter and thence to negative via a 0.1uF capacitor. The resistor and capacitor form a charging circuit whose time-constant is such that, in the absence of any current contributed by the Darlington transistor pair, the capacitor voltage ONLY JUST reaches the conduction point of the unijunction at the end of each mains half-cycle.

As it is the unijunction conduction which supplies a current pulse to transformer T1 to turn on the Triac, under these conditions the Triac is effectively "off" for all but a very small portion of the mains half-wave. The effective current passed is far below that required to produce a visible glow from an incandescent lamp or discernible heat from a radiator.

To turn the Triac on for increasingly greater proportions of the mains half-cycles, it is simply necessary to advance the conduction of the unijunction. This is done by using the Darlington pair to apply an increasing "bootstrap" DC voltage to the 0.1uF capacitor, so that the total capacitor voltage reaches the unijunction conduction level at earlier and still earlier phases in the half-cycle.

When the applied DC is itself only just short of the conduction level, the unijunction and Triac conduct almost at the start of each half-cycle. This is the "full on" situation, where the Triac delivers virtually full power to the load.

To slowly reduce the load power for "dimming down," the DC bootstrap voltage applied to the 0.1uF capacitor is simply reduced at the required rate. This produces the converse of the dimming-up operation: with each succeeding mains half-cycle the unijunction and Triac conduct at later and later phases until finally they are conducting

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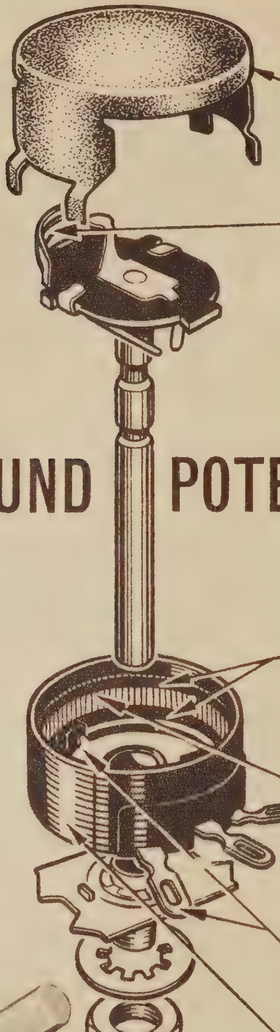
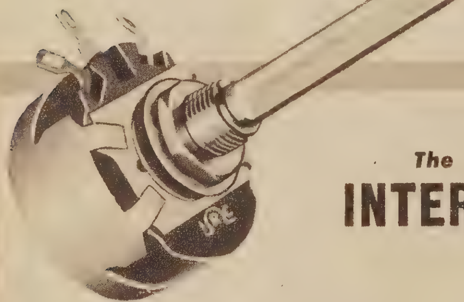

Dustproof cover.
Dual finger wiper—makes positive contact over full rotation.
Wire cemented to strip—cannot move or bunch.
Resistance element uniformly wound—for good linearity.
Unique collector ring and terminal design for noise-free operation.
One-piece phenolic moulding—efficient heat sink for better performance.

TYPE 2w
WIRE WOUND POTENTIOMETER

ELECTRICAL DETAILS
Power rating: 2.0 watts at 40°C ambient.
Standard resistance values:
min 2 ohms, max. 25,000 ohms.
Tolerance: ±10% standard (±5% special).
Effective electrical rotation: 280°.

MECHANICAL DETAILS
Bush mounting: ⅜" x ⅜" (32 N.E.F. —2 thread).
Shaft: standard length 2¼" from mounting surface.
Diameter: ¼".
Overall diam. of potentiometer: 1¼".
Overall depth of potentiometer: 21/32".



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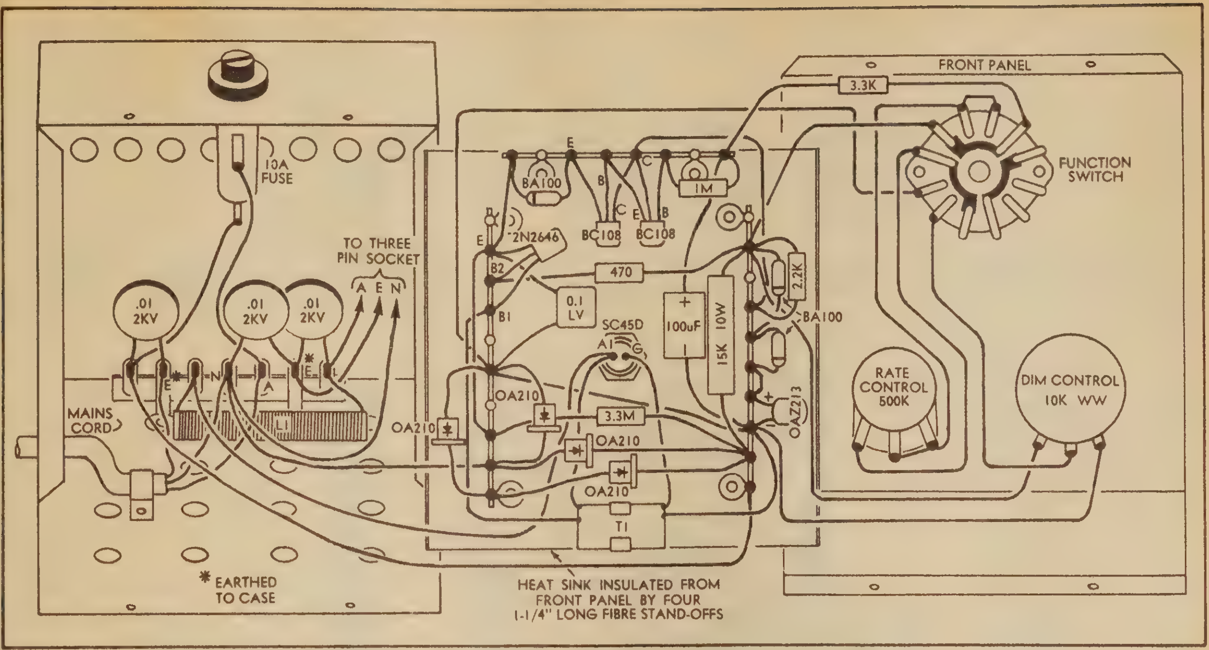
FRONT PANEL
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10A FUSE
TO THREE PIN SOCKET
A E N
.01 2KV
.01 2KV
.01 2KV
MAINS CORD
E
N
A
E
L
BA100
E
B
C
C
E
B
1M
2N2646
BC108
BC108
B2
B1
470
0.1 LV
SC45D
A1
G
100uF
15K 10W
2.2K
BA100
OA210
OA210
OA210
OA210
3.3M
OAZ213
T1
RATE CONTROL 500K
DIM CONTROL 10K WW
* EARTHED TO CASE
HEAT SINK INSULATED FROM FRONT PANEL BY FOUR 1-1/4" LONG FIBRE STAND-OFFS

Using the above wiring diagrams, the circuit and the photographs, construction should present few problems.

at almost the end of the half-cycles as before.

The DC control voltage applied to the 0.1uF capacitor is generated by the circuitry associated with the 100uF capacitor C1. It is actually the voltage across C1 during adjustable charge and discharge which forms the increasing or decreasing DC voltage.

The Darlington transistor pair is simply a means of reproducing this voltage at the 0.1uF capacitor while presenting very light loading across C1. As a cascaded-emitter-follower, the pair has a very high input impedance, low output impedance, high current gain but unity voltage gain.

To produce a rapid increase of load voltage for the "emergency fast on" function, C1 is charged quickly from the 13V line via the 3.3K resistor R1. This resistor also determines the shortest rise and fall times in the remaining positions of the function switch. However in both these positions the dimming rate can be extended considerably by inserting additional series resistance with the Rate potentiometer.

The 500K value shown for this pot provides a maximum time of approximately 50 seconds, as noted earlier. Naturally enough if it is desired to increase the maximum time still further, the pot value can be increased; however, if the value is raised much above a few Megohms the maximum available power output on UPWARD dimming starts to fall.

The reason for this is that while the Darlington transistor pair has a very high input resistance, its input resistance is still quite finite — approximately 7M, in fact. And this input resistance is effectively in parallel with the capacitor C1.

When the Rate pot is increased so that its value becomes comparable with the Darlington input resistance, for "upward

LIST OF PARTS

1	*Case, 5in x 5in x 5in, with sloping front panel.*
1	*Rotary switch, 3-pole 3-position single wafer.*
1	*Cartridge fuseholder, with 10A cartridge.*
1	*Trigger transformer (see text).*
1	*Suppressor inductor (see text).*
1	*SC45D silicon Triac device.*
1	*2N2646 unijunction transistor.*
2	*BC108, 2N3565 or similar transistor.*
1	*OAZ213 or similar zener diode.*
3	*BA100 or similar silicon diode.*
4	*OA210, 1N3194 or similar silicon diode.*
1	*470 ohm ½ watt resistor.*
1	*2.2K ½ watt resistor.*
1	*3.3K ½ watt resistor.*
1	*10K 2W wire-wound pot.*
1	*15K 10W wire-wound resistor.*
1	*500K linear pot.*
1	*1M ½ watt resistor.*
1	*3.3M ½ watt resistor.*
3	*.01uF 2KV ceramic capacitor.*
1	*0.1uF LV (30-100V) capacitor.*
1	*100uF 16VW electrolytic.*

Mains cord and plug, 3-pin outlet socket, 3 x fibre 1in spacers tapped ⅛in Whit both ends, 2 x 10-lug miniature tagstrips, 1 x 8-lug miniature tag strip, spring tool clip, scrap aluminium, 1 x 7-lug standard tagstrip, 1 x large knob, 2 x small knobs, connecting wire, insulating tape and sleeving, solder, nuts, bolts, washers, self-tapping screws, etc.

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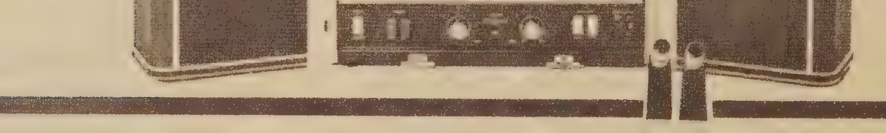

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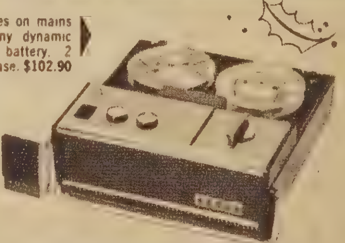

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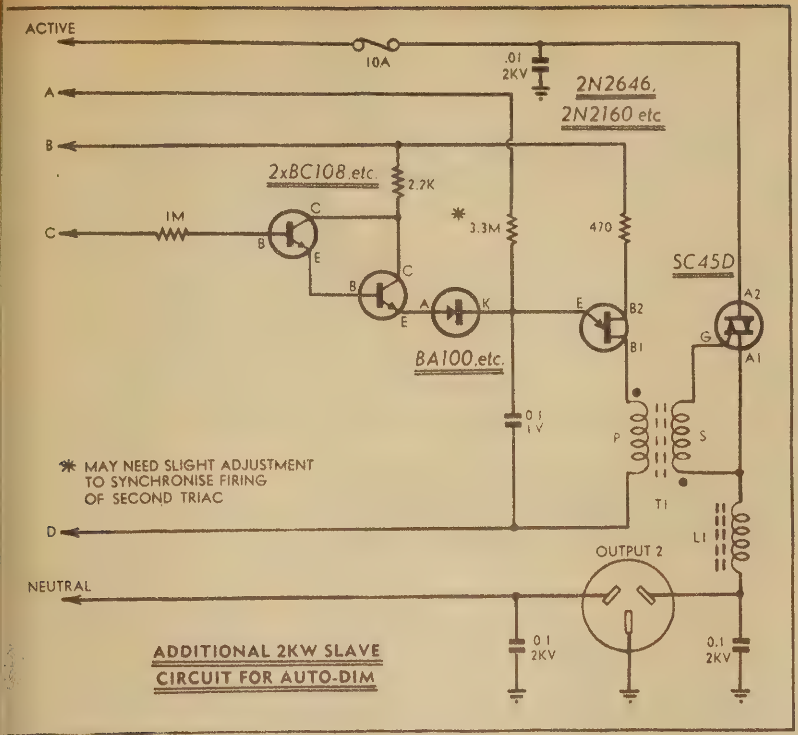

The circuit diagram for "add-on" 2KW slave sections which may be used to extend the capacity of the basic unit.

dim" the two form an effective voltage divider across the 13V supply. The result of this is that C1 cannot charge up to the full 13V, but only to a value determined by the divider. Hence full output is not reached.

Contrary to what one might expect the effect of the Darlington input resistance is far less drastic on downward dimming. This is because for downward dimming the Darlington resistance is simply in parallel with the discharge resistance, and thus merely sets a limit on the maximum available dimming time.

Very likely most applications requiring an extended automatic dim function will be interested mainly in the downward operation. This being the case there is no reason why the Rate pot cannot be increased considerably, providing the user remembers that for full output the Rate pot must either be turned well up or the switch turned to the "fast on" position.

A pot value of 5M might well be satisfactory for applications such as nightlight dimming, as with this value the maximum downward dimming time is almost 15 minutes.

Those who are interested in obtaining the maximum dim time may care to fit a four-position switch, using the fourth position as a "dim down" position in which the end of R1 is simply left floating. When this is done the Darlington input resistance is the sole discharge resistance in circuit, giving a dimming time of close to 30 minutes.

As may be seen from the circuit, there are normally two function switch positions apart from the "fast on" position; in both of these the Rate pot is in circuit. The first is the "dim" position, and the second is the "off" position.

In the Dim position the charging supply voltage may be varied anywhere from zero to the full 13V. This provides both a manual dim control (with the Rate control at maximum), and also an adjustable intermediate level to or from which the charging circuit can operate.

Thus if the unit is required for virtually manual dimming, the switch is simply turned to the central position, the Rate control adjusted to give the highest rate (shortest time), and the "Dim" pot used in the same fashion as the control on the Vari-watt manual dimmer.

For automatic operation, the Dim pot is set to a convenient "twilight" level and the Rate pot set for a convenient dimming time. Then the load can be dimmed either up from zero or down from maximum to this "twilight" level, and also dimmed from the level either down to zero or up to maximum.

It may be seen that the unit is thus quite flexible, and may be used to provide quite a variety of different effects and functions. the foregoing should also provide sufficient insight into the basic circuit operation to enable readers to modify the circuit to provide for special requirements.

At this stage, it should not be too difficult to see why the transistor supply voltage must be adjusted by varying the number of silicon diodes in series with the zener. If the supply voltage is too low, the voltage at C1 and hence the bootstrap voltage at the unijunction cannot rise far enough to provide maximum output; alternatively, if it is too high, control may be lost because the DC bootstrap voltage itself can exceed the conduction level of the unijunction.

The correct supply voltage is that which at "full on" allows the unijunction and Triac to fire at about 6 degrees

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or so after the start of each mains half-cycle—a phase corresponding to about one-tenth of the peak value of the mains half-cycle as viewed on a CRO. Higher supply voltages and correspondingly earlier conduction phases tend to make the unit unduly susceptible to line surges, causing the unit to produce violent flashing and other undesirable effects when turned to maximum.

Adjustment of the **minimum** output of the unit is carried out by varying the value of the nominal 3.3M resistor connecting to the unijunction emitter. If the resistor is too small, the emitter voltage will rise too quickly and it will not be possible to turn the load fully "off"; conversely, if the resistor is too large there will be too much "dead space" on the Dim pot and also too much delay when the load power is to be increased from zero.

The correct value of the resistor is that which, when the DC control voltage is at zero, produces Triac switch-on JUST BEFORE the end of each half-cycle. However, the adjustment is not unduly critical, and if operation is satisfactory with the nominal 3.3M resistor there is really no need to worry further.

The purpose of the silicon diode in series with the output of the Darlington transistor pair is to protect the emitter-base junctions of the transistors from breakdown damage which can otherwise occur when the voltage across C1 is low enough to result in the junctions being reverse-biased by the unijunction emitter voltage. The diode is necessary because most NPN silicon planar transistors available have a relatively low emitter-base reverse voltage rating (BVebo).

As with the Vari-watt unit, the Auto-Dim unit tends to radiate electrical interference as a result of the extremely rapid switch-on of the Triac. The suppressor inductor L1 and the three .01uF capacitors bypassing the mains and load wiring help to keep the interference to a minimum. The earthed metal case also plays an important role in this regard.

Although these provisions are normally quite effective, there is a small residual radiation which can sometimes cause trouble where the unit is operated in close proximity to high-gain audio equipment. If such equipment cannot be removed from the area, it may be necessary to fit mains filters and possibly also RF suppressor capacitors at appropriate locations.

As shown, the basic Auto-Dim unit employs a recently released 10 amp G-E Triac, the type SC45D. However, the 6 amp type SC40D unit used in the Vari-watt may be used alternatively if it is anticipated that loads greater than 1,200 watts will never be connected.

No circuit changes are required for this substitution, as the two Triacs have identical triggering requirements. Readers who have already constructed the Vari-watt unit may be assured conversely that the 10-amp Triac is also quite suitable for use in the earlier design, again without modification.

In order to forestall any requests for an Auto-Dim unit of even higher capacity than 2,000 watts—and high though this figure seems, it seems almost inevitable that some will find it insufficient—we publish details of an "add-on" slave circuit capable of providing synchronous control of additional 2,000-watt loads. This is shown in the auxiliary circuit.

The interference suppression components mount on a tagstrip at the lower rear of the case, along with the mains termination. Note the mains cord clamp and the ventilation holes.

As may be seen, it is simply a second power amplifier section, with Darlington pair, unijunction and Triac circuitry as before. The circuitry merely derives mains supply, high- and low-voltage DC pulse supplies and DC control voltages from the main circuit, thereby functioning in synchronism with the latter. The connections to the main circuit are identified by the code letters A, B, C and D.

A single slave circuit will effectively double the power handling capacity of the Auto-Dim; two such circuits will triple the capacity. Further slave circuits may be used if the need arises (!). However if more than two are used it will be necessary to reduce the value of the resistor in the upper arm of the main clipper-regulator, to maintain the 13V supply voltage.

Apart from this the only effect of adding further slave circuits is to reduce the absolute maximum dimming time, by virtue of the shunting effect of the additional Darlington pairs. A single slave will reduce this from 30 minutes to 15; two will reduce it to 10 minutes, and so on. However this will probably be of little concern in high power applications as the dimming times required will normally be from about 10-40 seconds.

Note that the nominal 3.3M resistor

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in the slave circuits may need to be adjusted slightly in value to synchronise the behaviour of the various Triacs over the lower portion of the range.

In passing it may be worthwhile pointing out that the circuitry shown in the auxiliary diagram is virtually that which would form the basis of a high power-gain amplifier for other applications. Thus by adding a mains isolation transformer and bridge rectifier and regulator-clipper as on the main circuit, the common line identified by letter "D" could be earthed, and DC input applied between this line and point "C."

As mentioned earlier it should also be possible to use the same circuitry as the basis for a high-power regulated DC supply. In this case the Triac would be replaced by two thyristors, an additional secondary being added to the trigger transformer to drive the second unit. The two thyristors would be connected into a full-wave or bridge rectifier circuit, and a reference-comparator circuit added to provide feedback regulation.

It may in fact be possible for us to give further details along these lines at some time in the future if there seems to be sufficient reader interest. However for the present the foregoing suggestions will have to suffice.

CONSTRUCTION

The construction of the basic Auto-Dim unit will now be described. As may be seen from the photographs, the unit is housed in the same compact 5in x 5in x 5in sloping-panel case used for the earlier Vari-watt and Vari-tach manual units. Despite the larger number of components in the new unit this does not involve undue crowding, and construction should still be a relatively simple job even for those with little previous experience.

The three controls are mounted on the front panel, with the function switch in the upper centre and the Dim and Rate controls at lower left and lower right respectively. At the top of the case is the cartridge fuseholder, while the left and right sides provide for the cord entry and output sockets respectively. Four rubber feet are screwed to the base to provide a non-scratching but secure support.

Sixteen ¼in diameter holes drilled in the base and a further sixteen holes of the same diameter drilled in the upper rear provide for a small amount of convection cooling of the components. Although the unit remains quite cool in operation, these holes are quite necessary for reliable operation and should not be omitted.

Inside the case the components are in two groups. The smaller group consists of the interference suppression components, and is positioned in the lower rear of the case proper. From this section only three wires connect to the larger group of components at the rear of the front panel, the second group consisting of the control circuitry proper.

As may be seen a majority of the components in the control circuit are supported on tagstrips screwed to a U-shaped aluminium bracket mounted at the rear of the front panel. The bracket is actually a heat-sink plate for the Triac device, which mounts at its centre. Being connected to the A2 electrode of the Triac the bracket is naturally "alive," and is accordingly fastened to the front panel via 1in fibre insulating pillars.

The bracket is bent up from a 5in x 3½in scrap of 16G aluminium to form a flat "U" 3in x 1in x 3½in. The Triac mounts in the centre via a ¼in diameter hole which should provide a tight fit for its threaded stud, in order to provide efficient thermal contact.

The photograph and wiring diagram show the position of the minor components and the wiring; using these as a guide it should thus be easy to duplicate the prototype. Note that the function switch wiring must be completed before the bracket is mounted on its tapped support pillars. Four washers will be required at each support pillar to ensure that there is adequate clearance between the heat-sink bracket and switch lugs.

Trigger transformer T1 and suppressor inductor L1 are both wound on small lengths of 3/8in diameter ferrite rod. That for T1 is 1in long, while for L1 is 2½in long. In both cases plastic insulation tape is used initially to form a base for the windings and finally to provide a protective sheath; additionally in the case of T1 the same tape is used to provide an insulating layer between the primary and secondary.

To obtain the required short lengths of ferrite rod it will usually be necessary to buy a standard length as supplied for broadcast receiver aerials. The rod cannot be sawn satisfactorily; however it can easily be snapped with the fingers if a triangular file is used to make a "nick" or groove at the required spot.

Inductor L1 consists of 50 turns of 18 B & S enamelled copper wire close-wound. Trigger transformer T1 consists of two 100 turn windings of 36-40 B & S enamelled wire, again close-wound. Here the primary should be the inner winding and the starts and ends of both windings should be identified in some way to ensure that they are connected into circuit correctly. Do not forget the tape between windings—this should be of at least two thicknesses to ensure adequate insulation.

Inductor L1 is supported on the termination tagstrip via its relatively heavy connecting leads. However as the leads to T1 are relatively light in gauge this unit should be mounted as shown in the photograph. A small spring clip of the type sold as a tool/utensil holder makes a convenient and secure mounting, being itself screwed to the heat-sink bracket.

When wiring up the unit take care that components are not damaged by overheating. This applies particularly to the semiconductor devices—Triac, unijunction, transistors and diodes — but also to the remaining components. A wise precaution is to grip the component leads with a pair of long-nose pliers so that the latter acts as a heat-sink.

It may be noted that the wiring diagram shows a wire link in series with the regulator-clipper diodes. This link is intended as a reminder that an additional diode may be required in order to adjust the maximum output level of the unit. If such a diode is required, it is wired in place of the link.

For the benefit of those who may anticipate some difficulty in obtaining the Triac and unijunction devices, we can advise that these components may be ordered via local parts suppliers from Watkin Wynne Pty. Ltd., of 32 Falcon Street, Crow's Nest, N.S.W.

The panel lettering on the prototype unit was made using rub-on wax transfer type, of which several brands are available. A coat of clear rapid-drying enamel sprayed over the lettering protects it from abrasion.

When the unit is completed, use a multimeter or other continuity tester to check that there is no connection between the heat-sink bracket and the metal case. Also make sure that the case is connected to the earth lead of the input plug, to guard against possible shock.

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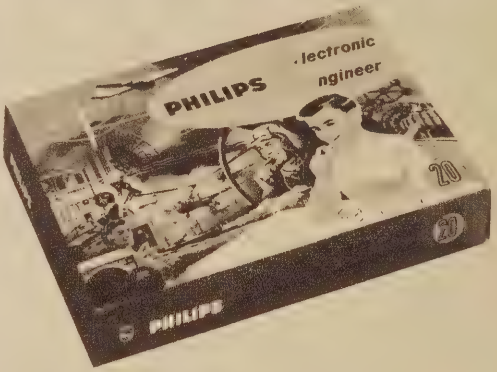

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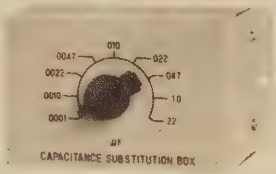

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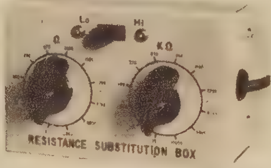

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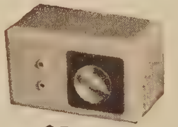

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PRELUDE TO AN SSB TRANSMITTER

The following is a description of the principles of a new transmitter which we have developed. The exciter and associated circuits are completely transistorised, valves being used only for the linear power amplifier and its driver. The transmitter may be built in full as described, or it may be simplified considerably to a quite modest but efficient unit.

By Ian Pogson

For some time now, the staff of "ELECTRONICS Australia," and the writer in particular, have been mindful of the need to present a modern single sideband transmitter suitable for construction by members of the Amateur Service. It is now more than three years since a SSB transmitter circuit appeared in these pages and, technically speaking, much water has flowed beneath the bridge in the interim.

Attitudes to the design of SSB transmitters have been modified and, even more important, preference has firmed for solid-state circuitry. In taking up the challenge, therefore, to present a new SSB transmitter for home construction, we have had to cope with all problems of a new design, complicated by a different approach and different circuit techniques.

Before launching into full constructional details, however, let us first take a look at the position and see what appears to be desirable and practical for such a project.

Needless to say, before anything of a practical nature was done, there was much thinking on the subject. We also took a look into the crystal ball in an effort to find out what Australian members of the Amateur Service really wanted.

In broad outline, here are some of the features which we considered would be demanded and which could be met without any great difficulty.

1. Modern in design.
2. Commercial-like in presentation.
3. Simple as possible, consistent with present-day requirements.
4. Designed such that it may be used in its "basic" form, but with extra bands and facilities which could be added later.
5. Relatively easy to align and adjust, with a minimum of test equipment.

The unit which we have developed and are about to present, meets these broad specifications and should have a wide appeal to our readers. In fact, it is hoped that it will meet the need of those amateurs who wish to advance to the ranks of SSB operators but have so far hesitated to do so.

It is not our intention to enter into a discussion of the pros and cons of buying commercially built amateur equipment. It is readily agreed that there are many cases where it is necessary or desirable to do so. At the same time, we firmly believe that the majority of Australian amateurs still wish to build their own and indeed, if a high standard of technical know-how is to be maintained, practical work is a must.

Perhaps the first question to be resolved is, should the new transmitter be of the phasing or filter type. On this question, the writer has no axe to grind, both types having advantages and disadvantages.

In the past, the phasing type of exciter enjoyed considerable popularity, possibly because it could be kept relatively simple and phase-shift networks could be purchased at moderate cost. (See our issues for Feb., March, April, May and October 1962).

Concurrently, the filter type was a little more difficult to build, mainly due to the fact that the filters were often made up of crystal lattice units from disposal sources and some serious obstacles had to be overcome in obtaining and adjusting the crystals to get the desired characteristics; provided these problems could be overcome, however, the resultant exciter was a very good proposition.

As a general rule, the amount of carrier rejection and sideband suppression with a filter type transmitter is greater than is normally achieved with a phasing unit. Furthermore, once adjusted, the filter unit can be expected to hold its characteristics for long periods; this cannot be generally claimed for the phasing method.

There is indeed, much room for debate on the subject but suffice to say that, recently, the trend has been to the filter method. Whereas phase-shift networks are not so readily available now, filters of various types are fairly easy to come by. And so it seems that the logical choice is along the lines of the filter system.

The next question to be settled is, shall we use a high or low-frequency filter? Again there are points for and against each of these approaches. The high frequency system can usually be made up in slightly simpler form but at some disadvantage in terms of operating convenience. High frequency filters appear to be available only in crystal lattice assemblies, though these are capable of a high degree of performance, particularly as regards skirt selectivity. Low-frequency filters are available both in crystal lattice assemblies and the now popular mechanical filter.

As far as price is concerned, very broadly speaking, there would be little to choose between the high or low frequency approach.

It was hinted that the low frequency system has some advantage to offer, in spite of the fact that an extra stage of frequency conversion is usually required. This extra stage can be used to switch sidebands, WITHOUT any shift in the nominal carrier frequency. This is a decided advantage at the receiving end, in that the operator does not have to re-tune his receiver as far as the reference carrier is concerned.

At this stage, it is becoming evident that we have talked outselves into using the filter system. Furthermore, the final decision has been in favour of the low frequency filter. We would hasten to point out that this is one point of view and it does not mean that the other

21-2 SSB TRANSMITTER
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Our new SSB Transmitter pictured above has that professional appearance which is so desirable these days. As such, it is able to compete with commercially built equipment. The unit is self contained and only needs to be connected to the mains together with control line to the receiver. Microphone and aerial make the unit ready for use.

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systems are not capable of doing an excellent job. The reasons for our decision will unfold as we go along and explain the system in detail.

Before embarking on a description of our prototype, we should perhaps take a look at more detailed specifications which should be met.

1. The unit to be self-contained, including power supply.
2. Capable of covering all high frequency bands, from 1.8 to 30MHz
3. Direct read-out of frequency for all bands, with as near to constant tuning rate as possible.
4. Facilities for quick band changing.
5. Ability to switch sidebands.
6. A high order of frequency stability.
7. In addition to SSB (A3a) facilities for transmitting A1 or A3 modes (CW or AM).
8. Sufficient power output so that it may be used alone or to drive a high power linear amplifier.
9. Emission to be clean and free from unwanted responses.
10. All components used to be available from normal stocks, without any "specials."
11. Availability of VOX if desired.

The new transmitter meets all these requirements, with one small reservation. We have not included the 1.8MHz (160 metre) band but it is an easy matter for anyone who wishes, to add the extra coils and one crystal. The crystal for this band is on 7MHz. This frequency, injected into the third mixer, with 5.0-5.5MHz subtracted from it, gives an output over the range from 1.5 to 2.0MHz. Thus, the 1.80 to 1.86-MHz band is included.

The unit is housed in a cabinet measuring approximately 14in wide x 7in high x 11in deep. A dual-ratio dial system provides a fast 6:1 ratio or a slow 36:1 ratio and the calibrations give direct read-out facilities for all bands. Band changing for the exciter is by a ganged switch, with tuned circuits broad-banded to avoid extra tuning controls. The final stage is switched and tuned separately. Sidebands may be changed by the flick of a switch. The frequency stability is such that it should satisfy the most discriminating user.

For the man who wishes to go after that rare DX station on CW, it is an easy matter to plug in and key the transmitter. Also, by means of the carrier re-insertion facility, it is possible to transmit an AM signal with one sideband. Although the power input is only 25 watts DC, this is sufficient for most of the time, particularly when working locally. When conditions are not good and long distances are to be worked, higher power may be desirable or even necessary. There is, however, sufficient output to drive a high powered linear amplifier in the passive grid configuration.

The components used should be available "over the counter" but it is almost inevitable that one may have to visit more than one supplier to get all the listed items. This appears to be the pattern, nowadays, regardless of the piece of equipment being built.

Push-to-talk is a normal provision and details are also given for a VOX system which we have developed, for those who wish to indulge in this refinement.

It is not our intention to go into a long discussion as to how the overall transmitter system was arrived at. However, we would like to mention that the system of frequency changing, together with the actual frequencies used, is due to G. R. B. Thornley and references to his work will be given at the end of this series. Suffice to say that we consider that the originator has done an excellent job.

As a matter of fact, the writer constructed a transmitter using this system some years ago and it has given every satisfaction. Thornley's original transmitter, which was described in the RSBG Bulletin in 1959, was followed by a modified version in 1964. Then toward the end of 1965, Dr P. C. A. Posford described a simplified version of the system, but with the exciter section completely transistorised. All this has led to the writer's present version of a comprehensive exciter which is all transistorised, with two valves only for the higher level linear amplifiers.

Before going into a description of the frequency changing system, we would like to point out that we are very mindful of the position of the average amateur and the intention is to present this project in such a manner that anyone with a reasonable amount of practical experience should be able to build and adjust the transmitter successfully. Although there are a number of stages to be considered, it should be remembered that if it is taken in "bite size" doses, then there is nothing to be afraid of at all. We wish to give as much encouragement as possible to the home builder and prove to him that it can be done.

Although it may appear to contradict what has just been said, modern equipment is more complex than in "the good old days." The state of the art has advanced tremendously and we, as members of the Amateur Service, must keep abreast of the times. The days when a M.O.P.A. transmitter could be built up with little more than a screwdriver and soldering iron are apparently gone for ever. At the same time, the idea that a SSB transmitter worthy of the name can be built up with a "knife and fork" and aligned with a multimeter, is so much hot air. However, the equipment necessary for alignment is usually found in the average amateur establishment and, if not, can usually be borrowed without too much trouble.

Attention is now directed to figure 1, which gives a block diagram of the complete exciter.

Before proceeding with the description, it will be an advantage to point out that it can be shown that, in the process of frequency changing, it is most desirable to keep the ratio of lowest input frequency to the required output frequency to a value no greater than 6:1. This assists materially in keeping the mixer output free of unwanted products. The frequencies used and shown in the block diagram meet this requirement.

From the block diagram, we see that we start off with an audio amplifier and a carrier oscillator, nominally on 455KHz. These are fed into a balanced modulator, after which we have a double-sideband signal with reduced carrier. This signal is fed into a mechanical filter, nominally on 455KHz, whereupon one sideband is filtered off and the other sideband is passed on to the 455KHz amplifier.

In actual practice, the carrier oscillator frequency will be such that it is positioned about 20dB down one of the

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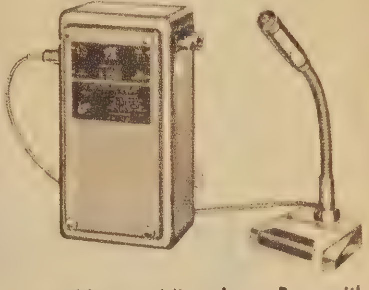

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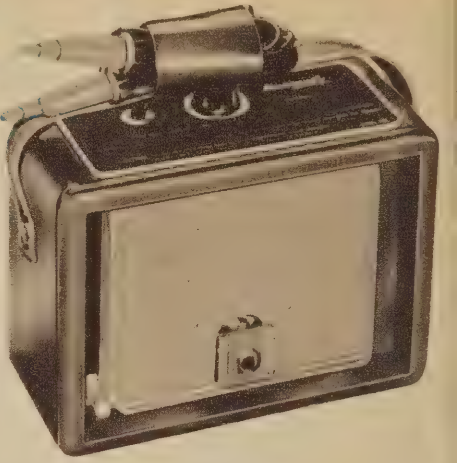

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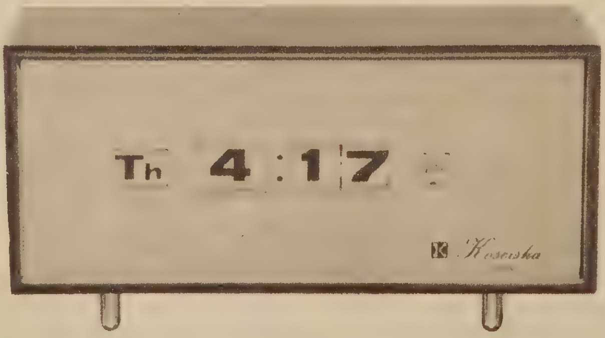

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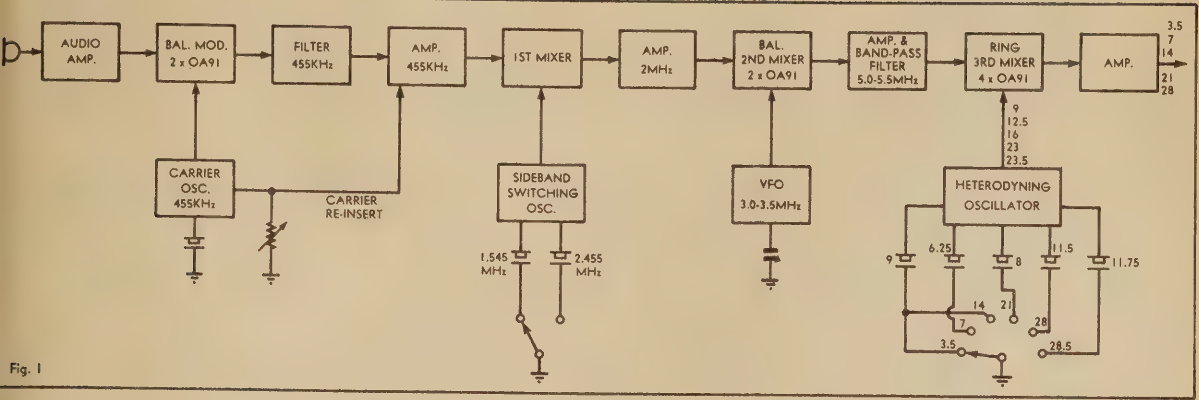

Fig. 1

This block diagram of the exciter shows clearly the various sections of the unit and, when read with the explanation in the accompanying text, no trouble should be experienced in grasping the principle of operation. It may be simplified as explained, to suit individual requirements.

kirts of the filter pass-band. This is hown in figure 2. If the carrier freuency is located on the low frequency ide of the filter, then a signal with pper sideband will be passed by the lter. Alternately, if the carrier freuency is on the other side, a lower ideband signal will be passed. This is f no great importance at this stage, ut it will be necessary to go into it in reater detail later on.

After amplification at 455KHz, the gnal is fed into the first mixer, the esired output of which is 2MHz. This equirement can be met by mixing the 55KHz signal with either 1.545MHz r 2.455MHz, adding in the first instance nd subtracting in the second. If we dd as in the first case, the sideband f the signal in relation to the carrier maintained. However, if we subtract, ien the sideband will be reversed. This a convenient method of switching debands and is, in fact, the method dopted.

Provided the two heterodyning crystals re exactly twice the carrier frequency part, then sidebands will be reversed ithout any change in the reference carer frequency—a very desirable feature.

After the first mixing process, the gnal is then amplified and passed on the second mixer. This is a balanced pe of mixer, similar to the balanced odulator. The reason for this will be ealt with later on.

So far, the signal, although it has een changed in frequency, it is not ariable. At the second mixer, we introuce the VFO, which tunes from 3.0 3.5MHz. This mixes with the 2MHz gnal and produces one which is varible from 5.0 to 5.5MHz.

As we now have a signal which is ariable in frequency, we will have to ake the output of the second mixer nable over this range or, we can use band-pass filter which will pass this nge of frequencies. Tuning would add ite an inconvenient complication to e control of the unit and so we use simple band-pass filter, which is two ned circuits overcoupled so that they ill give the required coverage. The sultant pass-band shape is double mped and it is shown in figure 3.

After amplification and having passed rough the filter, the signal is fed into e third and last mixing process. The ixer is a ring modulator and this will discussed later on. It is only necessary now to heterodyne this signal with injection from a crystal oscillator system, to come out at the wanted signal frequency.

If we mix 9MHz with 5.5—5.0MHz, subtracting we obtain 3.5—4.0MHz. Mixing 12.5MHz with 5.5—5.0MHz, again subtracting we obtain 7.0 — 7.5 MHz. By using 9MHz again and mixing with 5.0—5.5MHz, this time adding, we obtain 14.0—14.5MHz. Next, adding 16MHz to 5.0—5.5MHz, we obtain 21.0—21.5MHz. Finally, by adding 23MHz to 5.0—5.5MHz, we obtain 28.0—28.5MHz. It can be seen that this covers only a part of the 28MHz amateur band, so we add another crystal which gives injection at 23.5MHz, thus giving coverage from 28.5—29MHz. This is the extent of the coverage provided for this band but it can be extended by adding extra crystals, if this is considered necessary.

After wading through the above figures, it will be noted that the 3.5 and 7MHz bands are obtained by subtracting and all the other bands are obtained by adding the heterodyning injection frequency. This automatically gives the required change in the transmitted sideband, according to the normal custom of the high-frequency bands.

After the third mixer, the signal is amplified by the last transistor of the exciter. The signal is then of sufficient level to be used to drive the first linear valve amplifier.

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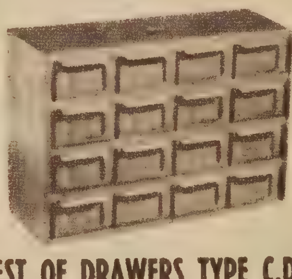

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diagram and, as mentioned in the last paragraph, the next stage is a linear amplifier, with a 6EH7 valve operated in class A. This stage in turn drives the final linear amplifier valve which is a 6DQ6B operated in class AB1. This is followed by the usual pi network, which in turn feeds the aerial.

Before proceeding, let us take a further look at what we have just covered. It will be seen that all the normal facilities are covered in this line-up. There will no doubt be some builders who will wish to leave out some of the facilities. This can be done with no trouble at all and a considerable saving in cost can result.

The sideband switching facility may be left out, as this is not normally used to any great extent. This will save the cost of a crystal and switch, as well as some other components.

Taken to its extreme, if an operator only wishes to use one band, then he can omit all the crystals for the unwanted bands, along with the two sets of tuning coils associated with the third mixer and driver stage. The rather elaborate band-changing switch also will not be needed. Of course a limited number of bands may be provided for, and additional bands may be added as required, without affecting the operation of the existing ones.

Another economy measure which could be used, is to substitute a self-excited oscillator at 455KHz for the crystal oscillator. There will be a slight degrading of frequency stability but it is possible to build a self-excited oscillator which will be acceptable for the job.

The point which the writer wishes to make is that, although the transmitter in its entirety can be quite elaborate, it is possible to simplify it considerably. The features left out may be added later as desired.

The solid state section of the transmitter used 14 transistors and these are the silicon planar types which are now very popular and at a price which is very attractive.

The power supply for the complete transmitter is taken from a single transformer, normally intended for audio amplifier use and so readily available at moderate cost.

The 6.3 volt AC source supplies the heaters for the two valves and is also the source for the 12 volt regulated line. The HT secondary is arranged as a voltage doubler, supplying 300 volts DC for the two valves. A dropping resistor and a VR150 regulator tube provide 150 volts for the screen grid of the 6DQ6B valve. Finally, about 90 volts negative DC bias is obtained from a separate rectifier, to bias the 6DQ6B and for muting purposes.

Although it is often controversial matter, facilities have been provided for those who wish to incorporate VOX control. The system which we have developed is somewhat more elaborate than some we have seen but it really does the job properly and it is most reliable. Including the anti-trip circuit, the system adds an extra six transistors to the total.

A suggestion has been made to the writer which involves the use of different crystals for heterodyning in the third mixer, up to 14, 21 and 28MHz. Instead of changing over to the low frequency side whereby frequencies on 9, 16 and 23MHz respectively are used, we could stay on the high side and use frequencies of 19.5, 26.5 and 33.5MHz, instead. This means that the sideband switching crystals would have to be incorporated into the general switching system, to obtain the conventionally correct sideband on transmission. The advantage which this system offers, is that the VFO tunes in the same direction for all bands, whereas it is reversed between the 7 and 14MHz bands. We have not investigated this idea closely but it does give some food for thought.

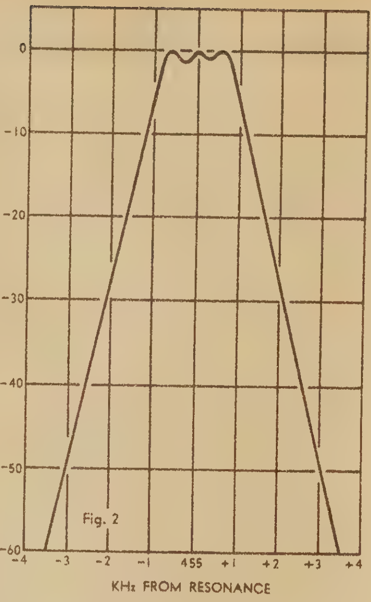

Fig. 2

This passband curve gives a good idea of the characteristics of the Kokusai mechanical filter which we have used in our transmitter.

After this general description the reader will have a good idea of the overall scheme, particularly with respect to the frequency changing sequence. This clears the way for a somewhat more detailed description with emphasis on the stages used and the specific requirements.

The audio amplifier consists of two stages, with the gain control after the first stage. Sufficient gain is available to use a crystal or dynamic microphone with the output level from the second stage more than sufficient to feed the balanced modulator. When using the usual type of transistor in the first stage, an excessive level of noise was noted with the gain control turned right up. If it is necessary to run the gain control at or near this point, it would be better to fit a low noise transistor.

The carrier generator consists also of two stages, the oscillator followed by an amplifier. The output of the amplifier is coupled into the balanced modulator via a modified 455KHz transistor IF transformer.

A mechanical filter follows the balanced modulator and we elected to use one made by Kokusai. The price is reasonable and they are readily available from the local distributors. Although other brands could be used, we have not had the opportunity of trying any and so are not able to comment on the respective merits of different makes.

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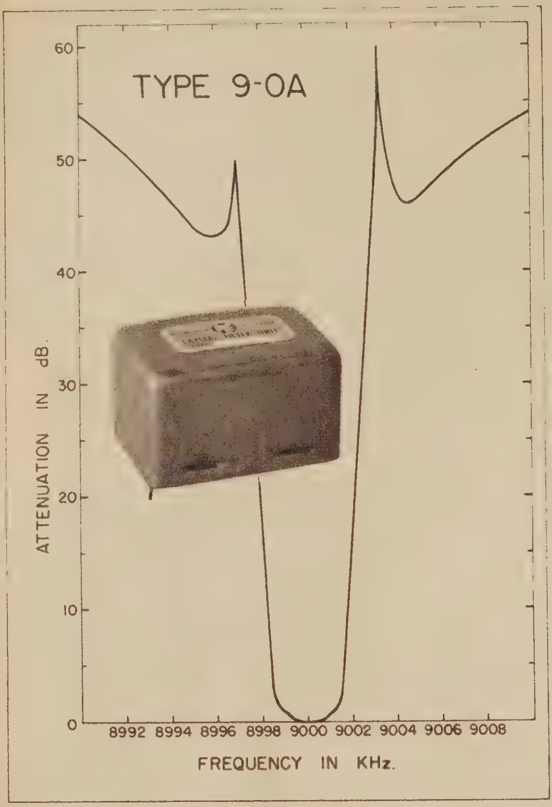

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or a nominal frequency of 455KHz ind each unit is supplied with the char-icteristics tabulated so that it may be lovetailed in with other relevant ircuitry. This applies particularly to the requency to be used for the carrier scillator. The 20dB points are given or each skirt and it is normal that the arrier be placed at one or other of these oints.

The two 20dB points of the filter hich we used are on 453.90 and 56.37KHz, respectively. Either of these oints may be used; we elected to use he 453.90KHz point and a crystal was rdered accordingly. The decision as to hich side to use is tied up with the

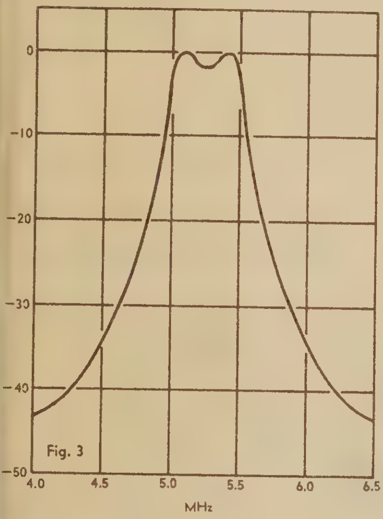

Fig. 3

This curve shows the approximate shape of the 5.0-5.5MHz band-pass filter. Adjustment details will be given later on.

leband switching crystals and this as-ct will be dealt with shortly. If the w side is selected, as in our case, en the crystal which will give the con-ntional sideband on actual trans-ission, will be the one on the lower equency.

As the level at the output of the echanical filter is quite low, it is nec-ary to put it through an amplifier. e amplifier output is coupled into the xt stage via a conventional 455KHz nsistor IF transformer. In parallel th the input to this amplifier, is a pot-tiometer taking the output from the itter of the carrier amplifier. This nal can be fed into the IF amplifier d thus provide carrier insertion.

Following the 455KHz IF trans-mer, is the first mixer. The three xers are of considerable importance d a pause to give some extra informa-n on this subject should be worth ile in making their functions better derstood.

n the original valve version, as pre-ted by Thornley, the desirability was nted out of using balanced mixers to oid trouble with unwanted break-ough of the injection frequency. How-r, in his transistor version, Posford ntioned that, due to the low imped-es involved with transistor circuitry, problem was not so serious and simp-circuitry would suffice. It is not the ntion of the writer to criticise this tement and it is assumed that Dr sford had no trouble.

After installing a simple mixer, the experience of the writer was such that there appeared to be too much breakthrough of the injected signal, as seen at the output of the 2MHz tuned circuit. An alternative appeared to be some sort of balanced mixer and some were tried with some varying success. A half-Cowan circuit was then considered, similar to the balanced modulator. The objection to this was in fact that it needed a balanced injection input and this was not available from the oscillator circuit, which had been adopted with otherwise complete success.

At this stage, the idea of using a ring modulator had not been considered. The easiest way out seemed to be to increase the "Q" of the 2MHz tuned circuit. This was done by winding the coil on a small toroid, which fitted conveniently into the can of the original slug-tuned coil. It was then necessary to tune the circuit trimmer but this was no problem. The scheme worked out very well and the rejection was brought to a satisfactory level. It may not have been necessary to go to the trouble but, in the long run, the level of spurious response will be lower and it is better to be sure than sorry!

The oscillator associated with this mixer is the sideband switching oscillator, previously referred to. In our case these crystals are 453.9KHz above and below 2MHz, which makes them 2.4539 and 1.5461MHz, respectively. As our carrier is placed on the low frequency side of the filter pass-band, the 1.5461 MHz crystal gives the correct sideband on transmission. The other crystal is only used when it is required to transmit on the other sideband. If the other side of the filter had been used for the carrier, then the reverse would be true.

The output from the first mixer is fed via the high "Q" tuned circuit into the second mixer. The VFO which tunes from 3.0-3.5MHz, is the injection for the second mixer. This gives an output from the mixer which varies over the range, 5.0-5.5MHz.

Unless the component from the VFO, between 3.0 and 3.5MHz is suppressed and so prevented from finding its way into the signal circuits, it could appear as a spurious response in the output, particularly when operating on the 3.5 MHz band. This is a somewhat similar state of affairs as encountered in the first mixer. The way in which this has been solved is by using a half-Cowan type of balanced mixer, similar to the balanced modulator. This reduces the level of the VFO component to a satisfactory level.

As the output of the second mixer is quite low, it is followed by an amplifier. After amplification the signal passes through the 5.0-5MHz bandpass filter. This produces a set of conditions which if not considered carefully, could result in a number of spurious responses appearing in the output.

It will be noticed that, after the third mixing process, the output is at signal frequency. First, let us consider 3.7MHz. This is not far removed from 5.0MHz, which is readily passed by the previous stage; due to the relatively low operating "Q" of the 3.7MHz circuit, although somewhat attenuated, it could appear at a level above a safe minimum. Similar consideration can also be given to the relationship between 7.0 and 5.5MHz.

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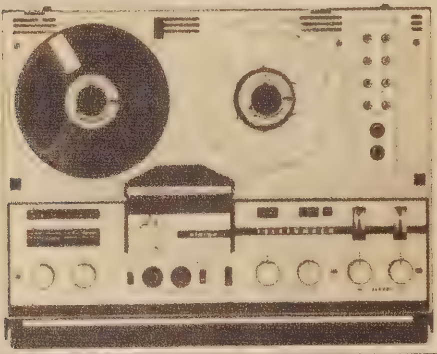

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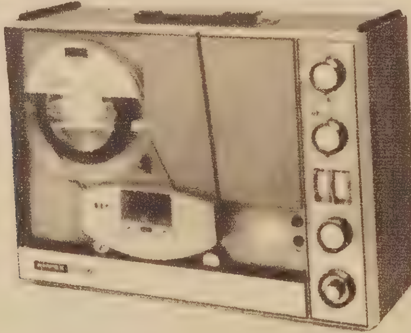

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we also have another possible source of spurious response, more subtle than the others. Consider the fourth harmonic of say 5.3MHz from the band-pass filter. This produces a signal at 21.2MHz, a most undesirable condition. It could be possible to net in the 21MHz band, using this spurious signal rather than the legitimate one.

With these sobering thoughts in mind, it was decided that the best type of mixer for this position would be the "double balanced" or "ring" modulator, so commonly used in telephone circuits. Although we will not go into it at this stage, we would like to reassure readers not familiar with the circuit that it is quite a simple arrangement and no trouble at all to get working.

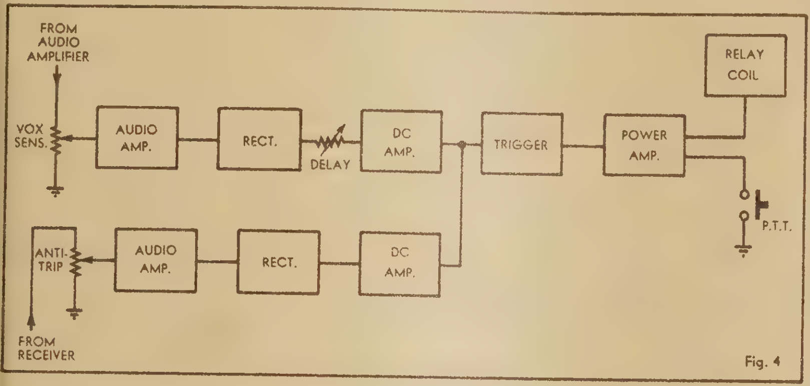

Fig. 4

The VOX unit is shown here in block diagram form and details of its operation will be given in the next part of the series. Tests on the air have indicated that it is unobtrusive in operation.

Using this ring modulator means that not only does it prevent the injection frequency from appearing in the output but the input signal is rejected from the output as well. This is just what is wanted and the problem is resolved.

Although the efficiency of the ring modulator is such that the output is double that from simpler balanced modulators, it is still necessary to lift the wanted signal in another amplifier. This gives a signal at about 2-3V, sufficient to drive the first linear amplifier valve.

Tuned circuits in the output of the last two mentioned amplifiers are selected by the band-change switch. These circuits are broadbanded such that they do not require any external tuning controls, which facilitates changing from one band to another.

The final linear amplifier is quite conventional and needs no further comment at this stage.

The power supply for the transistors is regulated with a zener diode and a transistor functioning as a shunt regulator. Adequate filtering is provided, using electrolytics in a passive role, rather than using the dynamic method. There does not appear to be much to choose between the two methods, the passive system being chosen on the grounds of simplicity.

It should be pointed out that extensive iltering of the power supply is essential f the carrier suppression capabilities of the system are to be realised. If there is oo much ripple on the supply line, it vill give rise to a "pseudo" carrier and no amount of care in adjusting the balınced modulator will get rid of it. The ipple is also manifested as hum appearng in the speech amplifier.

So far, little has been said about the VOX circuits. The reason for this is to emphasise the fact that this is an optional extra. The block diagram is shown in figure 4. Some of the audio signal is picked off the collector of the first audio amplifier and fed into the VOX amplifier, via a sensitivity control. The audio is rectified and used to switch a series of DC amplifiers, the final one operating the relay. A variable time delay is incorporated, to control the "hold-in" time.

In common with other VOX circuits, an anti-trip system is also included. Audio from the voice coil of the receiver speaker is fed into an amplifier, through an "anti-trip" control. The amplified signal is rectified and the recovered DC is used to hold the relay circuit in the unoperated condition. In other words, this prevents sound from the speaker into the microphone from triggering the VOX.

Since its completion, the transmitter has been tested on the air. Listeners at the other end reported that they were not aware that VOX was being used, which is the best report which could be received.

This preliminary discussion of the transmitter, before the constructional articles to follow, should pave the way to a better understanding of the circuit details and so make it easier to undertake the project. If you are already taking side glances at your piggybanks, our purpose is well on the way to being realised!

(To be continued)

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The Serviceman

TECHNICALITIES AND DIPLOMACY

This month's main story raises the problem of an owner dissatisfied with a previous serviceman's charges and general integrity. How does one react in such a situation? Side with the customer? Defend the serviceman? Or remain neutral? "It all depends . . ." as they say, but the right decision sometimes calls for a lot of thought.

First, however, here is what might be called a sequel to one of last month's stories. Readers may remember I finished up with a story about an unusual speaker fault in a car radio. Almost immediately I was confronted with another equally intriguing fault.

It also concerned a car radio, which the owner had very thoughtfully removed from the car and simply dumped on the counter. His complaint? Very severe distortion, and lack of sensitivity.

There was no doubt about it either, it was completely unintelligible and well down in sensitivity. In fact, I formed the impression that one or other of the audio stages was working under grossly wrong conditions or the speaker had packed up completely.

I checked the speaker first. Voice coil resistance was normal, and when I applied gentle finger pressure to the centre of the cone, the whole assembly moved as freely and quietly as one could wish. By all the rules, the speaker seemed above suspicion.

Then I tackled the audio stages. I went over them with the proverbial fine tooth comb, checked every voltage, replaced both valves, and generally satisfied myself that the stage should be working normally. Yet the distortion persisted.

Suddenly I had a horrible suspicion. Suppose the speaker, in spite of the tests I had made, was faulty. I substituted a new speaker and, presto! Beautiful music. (Well, it sounded beautiful to me, anyway).

Mentally kicking myself for being caught so easily, I took another look at the offending speaker. I checked the voice coil again, and it read normal; I fingered the cone, and it moved freely. Yet the speaker was faulty.

On an impulse, I shook it rapidly up and down several times. I was rewarded with a "clink-clunk, clink-clunk" sound in time with the shaking. Something reasonably substantial was loose somewhere in the "works," and I suddenly remembered a story I had heard, years ago, about a speaker in which the voice coil former had become detached from the cone and was simply sitting in the annular gap.

Since the speaker was a write-off anyway, I took a razor blade and cut around the edge of the cone and the suspension disc. Then I carefully withdrew the cone. The result was not quite what I expected, but very similar. The voice coil former was still intact, but the voice coil itself had slipped off it, the former apparently having shrunk quite appreciably.

As can be seen from the photograph, I was able to fish the coil out of the annular gap more or less intact, only a couple of turns having come adrift from the main structure. Even so, it was still intact electrically.

I must be more suspicious in future.

And now for the main story. There were no profound technical problems involved, but it is a good example of a set with a lot of little things wrong with it; little things which had caused the owner considerable annoyance and inconvenience. There was also more than a little evidence of a shady deal somewhere in the set's service history.

The customer was a new one, and his initial telephone call simply indicated that the set was giving trouble in the channel selector. However, when I arrived at his home I sensed a rather different situation. For one thing, there were several other faults, including a horizontal white bar across the screen and, as the customer described it, ". . . an uneven picture." (Poor vertical linearity.).

I also sensed that servicemen in general were not a very popular species with this gentleman, and that I was very much "on trial." One of the first points he raised was the probable cost of the job; something which I had to explain could not normally be forecast, due to the unpredictable nature of most faults. However, I did explain the basis on which I charged, and this seemed to allay his fears to some extent.

In fact, it seemed to prompt him to unburden some of his troubles in regard to previous service. In particular, he mentioned the last time this set had exhibited similar symptoms, i.e., trouble in the tuner, and I had to admit that he had quite a tale of woe.

One of his main complaints was that the serviceman had taken the set away and kept it for about a fortnight. Then when it was returned, he presented a bill for about £22 which, according to the owner, was based mainly on supplying and fitting a new tuner.

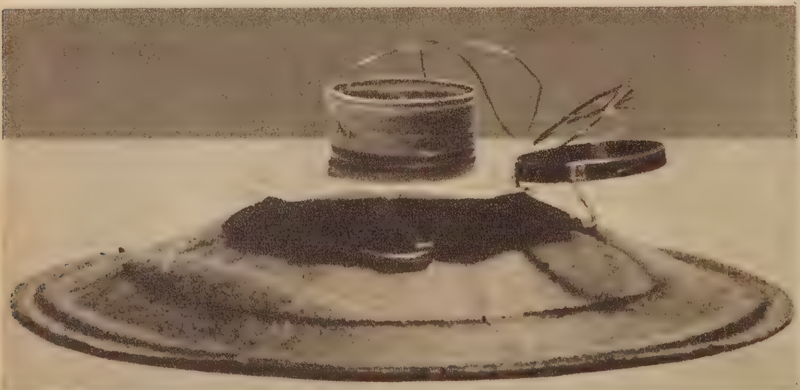
For the most part, I don't like taking sides in such cases. There are always two sides to every story, and it is all too easy to become involved in an argument arising out of customer misunderstanding, unless one has an opportunity to hear the serviceman's story.

Nevertheless, I had to admit — to myself at least — that this was a big bill by normal standards and might take some justifying. Normally, if a tuner is in such bad condition as to justify replacement, one would fit a reconditioned tuner, exchanging the old one as part payment (this eventually becomes a reconditioned tuner for somebody else) plus a fixed difference of a few pounds. Even allowing for the cost of removing and refitting, the total cost would be nothing like the figure quoted. About the only basis on which such a figure could be justified would be the retail price of a brand new tuner, plus fitting costs; a most unlikely circumstance.

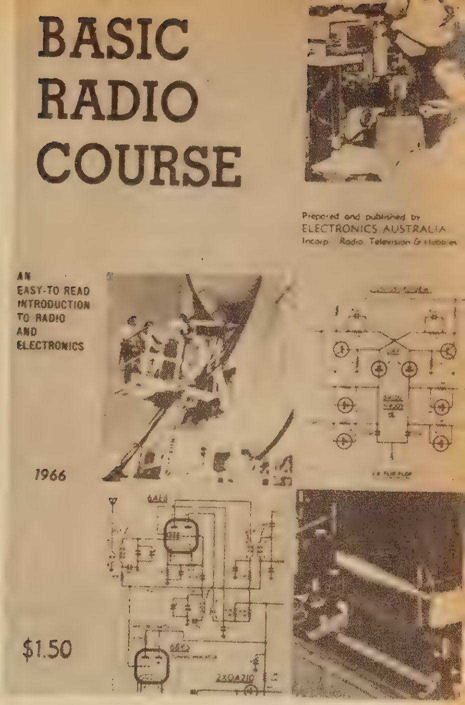
However, I kept these thoughts to myself. Even when the customer produced the account in question, it really did little to clarify the situation. True, it confirmed the amount involved, but it was noticeably lacking in detail. It simply said, "Repairs to TV set, XYZ brand, model 1234." There was no mention of a tuner or, indeed, any other components. I could only assume that this information had been conveyed verbally.

But right now I was more concerned with the current technical problems. A check on the set's behaviour confirmed that the tuner was behaving poorly. It was necessary to rock the selector knob back and forth several times in an effort to make the picture lock and, even when it did, the picture was noticeably snowy.

In addition to the white bar and non-



The cone and voice coil assembly of the faulty speaker. Note how the coil has remained virtually intact after slipping off the former. Superficially, there appeared to be no fault in the speaker.



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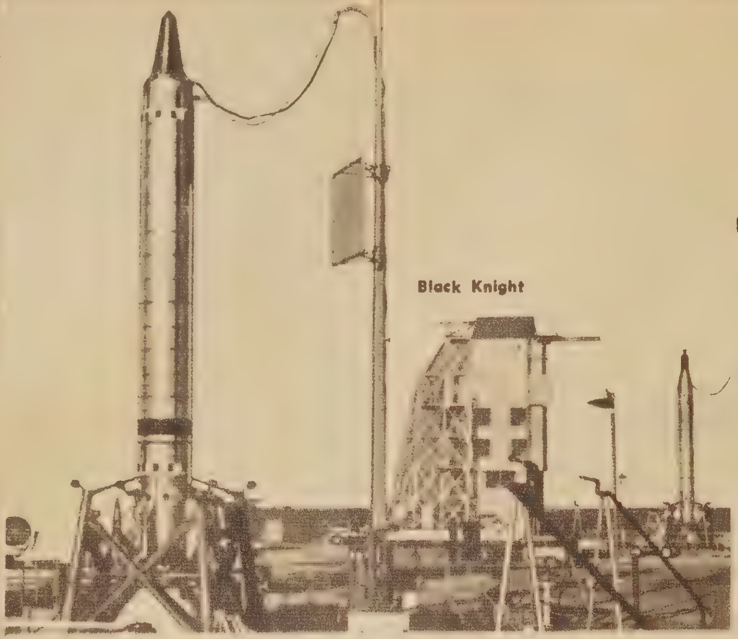

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linearity already mentioned, closer examination showed a tendency to vertical underscanning, an effect which was sometimes much worse, according to the owner. And, in answer to some prompting, he agreed that the picture was prone to roll.

At this stage I wasn't quite sure whether the tuner problems would necessitate a workshop job or not but, in any case, the chassis would have to come out. When it was finally withdrawn and I had a chance to examine the chassis, a very interesting fact was revealed. The tuner, the cause of all the upset, was very obviously the original one. So much for any claims about a new tuner.

How could I be so sure? Well, for one thing, the tuner looked old, even though this may be a difficult thing to explain in detail. But there were at least two much more precise indications, both involving the soldered joints.

This manufacturer has a habit of twisting all pigtails through and around tagstrips several times before soldering; a habit which, in the normal way I deplore, but which proved quite useful in this case. In addition, he is one of several manufacturers who paints the joints with coloured lacquer, presumably as a mark of inspection. It was very obvious that neither the paint nor the pigtails had ever been disturbed.

What should one do in a case like this? As I said before, I had no desire to become involved in an argument with another serviceman, particularly as there is always the risk of some misunderstanding. On the other hand, there was no question in my own mind that the tuner had never been changed, and I felt I owed the customer something if there was any chance that he had had a raw deal.

In the circumstances I contented myself with pointing out that the tuner had not been changed, and the reasons why I believed this to be so. It was up to him to decide whether this was at variance with what he had been told and whether he should do anything about it. Then I went on with the job.

I tackled the tuner first. As far as I could see it was mechanically sound with no detectable play or slop in the shaft. I slipped the cover plate off and examined the circuit contacts. They appeared to be quite springy and exerting good pressure on the coil contacts, but both sets of contacts were badly tarnished.

Tuner contacts are normally silver plated and, due to the relatively soft nature of silver, abrasive cleaning should be avoided. A good proprietary cleaner is CRC 2-26, a moisture inhibiting liquid which has many other uses around electronic equipment. A light spray with this, followed by a polish with a soft cloth, will leave the contacts clean and shining. What's more, the effect appears to be as long lasting as anything I have tried.

I checked the tuner on the air and found that it was now selecting each channel quite positively, but the background of snow remained. I tried adjusting the AGC control, in case anyone had been fiddling with it, but this produced no improvement. Then I tapped the tuner lightly with the handle of a screwdriver, producing a marked effect on the picture. This became more obvious when I tapped the RF valve, so I tried a new valve. That cured the snow.

Next I considered the picture roll and loss of height, mainly because I considered I could pick this in one. The vertical oscillator uses a 12AU7 in a multivibrator circuit, and the frame hold control is a 100K pot. The moving arm of the pot. goes to the grid of one triode, one end goes to chassis, and the other end to the HT line via a 560K ½W resistor. This network provides a variable positive voltage on the triode grid; a popular form of hold control in multivibrator circuits.

The 560K in this circuit goes high so consistently that I am hard put to it to remember one of these sets in which I have not had to replace it. The result is both reduced multivibrator activity, causing lack of height, and a change in the natural frequency, making it difficult to lock.

A new resistor, of larger wattage and a more stable type, cured that trouble—for all time I hope.

But the overall non-linearity and the white horizontal bar remained. As you have probably guessed, the white bar was simply an extreme condition of non-linearity, severe bunching of lines producing a significantly brighter image in this part of the picture.

Non-linearity is quite a common fault in this model, particularly as it is a fairly old one, and the passage of time is producing a crop of deteriorating resistors and capacitors. I have found the best approach is to go right over the frame oscillator and output circuits and check all likely capacitors for leakage and resistors for value. The high value, half watt resistors in particular have a habit of doubling or tripling their value.

Nor did I have to look very far. The line output stage is the pentode portion of a 6BM8, and part of the circuitry is a feedback line from plate to cathode; a popular arrangement for improving linearity. There are two capacitors in the line, a .033uF and a .1uF and they are effectively in series. These two capacitors are quite critical, both in regard to value and insulation. As it turned out both were leaky, one to the tune of 4M and the other about 8M. Their replacement produced a worthwhile improvement.

Further improvement resulted when I checked, and replaced, a 4.7M resistor in the plate circuit of the 12AU7 multivibrator. It was reading no less than 10M.

In all, my inspection of the stage revealed no less than four leaky capacitors, and five resistors well out of tolerance. Only those already mentioned had any significant effect on performance, but there is little doubt that the others would have given trouble eventually. The cost of replacing them now was small, but would be considerable at a later date: a fact I was careful to point out to the owner, who obviously appreciated the point.

At this stage the linearity was noticably improved, but the most serious aspect of the trouble, the white line, was still in evidence though slightly improved.

I had struck this trouble before too, and it usually turned out to be the 6BM8. Sure enough, a new one completely cured the trouble and a few minutes juggling of the height and linearity controls produced a near perfect image, with plenty of scan in reserve.

Which just about wound up the job, as far as fault chasing was concerned. I fitted the chassis back in the cabinet, checked the slugs in the tuner against the fine tuning control, checked the AGC control, and generally gave things a "once over." By the time I had finished, the set was performing in virtually new condition; a situation which always gives me considerable satisfaction.

And, judging by the customer's reaction, including the spontaneous manner in which he shook my hand as I left, he was very satisfied too. I imagine I have won myself a new customer with that job. ▬

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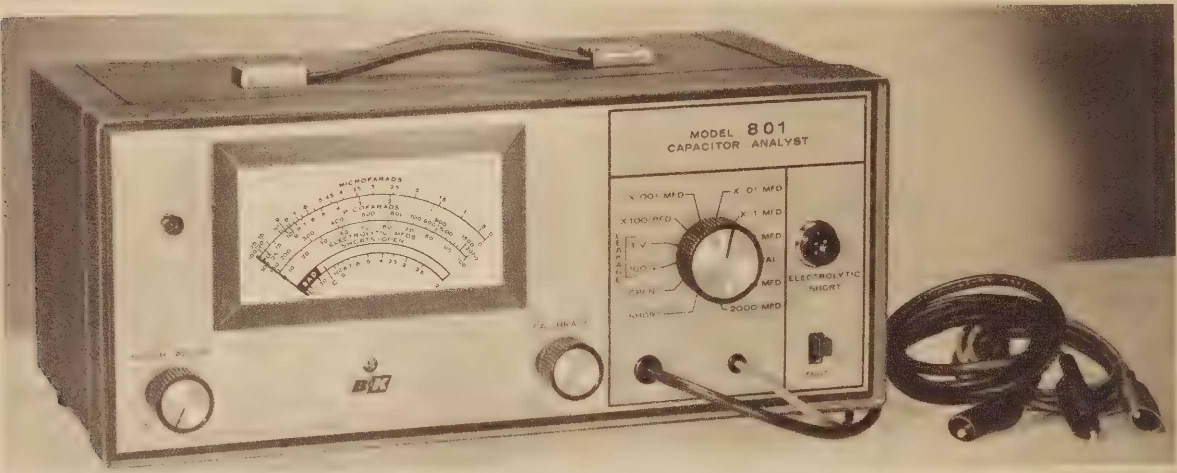
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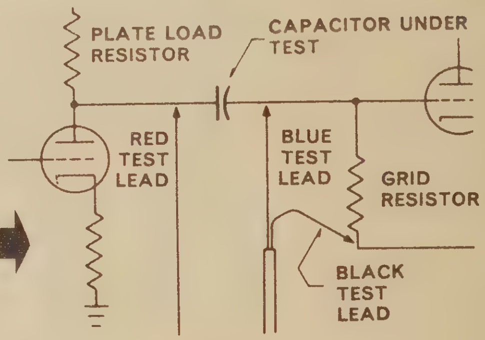
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VALVES GIVE WAY TO TRANSISTORS

A new, hybrid television receiver, which has just been released by Pye Industries Ltd., represents something of a landmark in Australian TV receiver design, by reason of its very high degree of "transistorisation." For the interest of readers who may wish to study the design techniques involved, we reproduce the circuit in full, together with relevant notes by the chief engineer of the Company.

By J. E. Cope, M.I.R.E.E. (Aust.), M.I.E.E.E. (U.S.A.)*

Late in 1965, the availability in Australia of silicon planar transistors, at reasonable cost, led to a study of the possibilities of using them in a full performance large-screen TV receiver.

It soon became evident that transistors could not yet compete on a cost-performance basis in the power stages but were very promising for use in the small signal areas. A start was, therefore, made on the development of a complete receiver on this basis.

Unfortunately, a satisfactory transistorised tuner was not available and a valve tuner had to be used.

The circuit design finally adopted is designated T.23 and employs the following active devices:—

Seven valves:
  Two in tuner.
  One in audio amplifier.
  One in vertical time base.
  Three in horizontal output stage.
Twelve transistors:
  Three in video IF amp.
  Two in video amplifier.
  Two in AGC circuit.
  One in sound IF amp.
  One in sync. separator.
  One in vertical timebase.
  Two in horizontal timebase.
Ten silicon diodes:
  Four in power rectifier bridge.
  Two in sound ratio detector.
  One in AGC.
  Two in horizontal time base.
  One in vertical timebase.
Germanium diode:
  One as video detector.
Temperature dependant resistors:
  One in scanning yoke.
  One in horizontal timebase.
Voltage dependant resistors:
  Two in vertical timebase.
  One in brightness circuit.
Cathode-ray tube:
  One.

Comment follows on the major sections of the circuit.

VIDEO IF AMPLIFIER

The main points in the original design criteria, and ultimate performance specifications are as follow:

The voltage output of the tuner and the input sensitivity of the video amplifier are such that 1 millivolt RMS at the first base should produce one volt of DC at the detector (maximum gain).

The passband should have a smooth response in order to avoid phase distortion and the bandwidth as wide as the practical design of the adjacent channel traps allow. More typically, bandwidth should be less than 6dB down at the 4.5MHz point and the fall in response of the vestigial sidebands should be substantially linear with the vision carrier 6dB down on the mid-frequency video response.

Some 26dB reduction in the level of the sound carrier relative to the video carrier is necessary in order to avoid cross-modulation effects on the picture.

Up to 60dB rejection of the adjacent sound and video carriers is necessary for satisfactory reception in some country areas.

The detector output should be sensibly free from harmonics to avoid patterning.

The detector should have sufficient voltage output to drive the video amplifier with an adequate reserve before non-linearity occurs.

The dynamic video response of the detector should be sensibly flat to 5.5MHz.

Approximately 24 to 30dB of control is required before the AGC is applied to the tuner. More control than this is undesirable since mixer cross-modulation may then occur.

The T.23 meets these requirements in the following manner:—

The gain is achieved in two stages, the first being a cascode arrangement of two transistors and the second a neutralised grounded emitter amplifier. Coupled pairs of tuned circuits are used between tuner and cascodes between cascode and final, and between final and detector.

Reduction in the amplitude response of the vestigial sidebands is obtained almost entirely in the tuner/IF coupled pair, thus ensuring a good approximation to the theoretical requirements.

Discrimination against adjacent channels is provided by traps placed across the coupling element in the tuner/IF coupled pair. Two of the traps are of the infinite rejection type and have a minimum effect on the passband.

The first and second coupled pairs are slightly below critical coupling, as it has been found that the bandwidth varies less in production than with over-coupled pairs; also the resulting smoother frequency response minimises phase distortion.

The final IF/detector pair is very slightly over-coupled, in order to hold up the response at the higher video frequencies. This last pair provides the detector with a sensibly flat source impedance and, in conjunction with the wide-band filter incorporated in the diode load circuit, achieves a video response flat to 5.5MHz.

The filter comprises three broadly resonant chokes with printed circuit capacitors and ensures that radiation of IF harmonics will not cause patterning, even when a rod antenna is used.

Gain control is achieved by forward biasing the bottom transistor of the cascode stage.

The overall sensitivity of the T.23, including the tuner, is 20 microvolts RMS into 300 ohms.

VIDEO AMPLIFIER

The two transistor video amplifier has a voltage gain of thirty times from DC to 5.5MHz. The arrangement comprises a PNP transistor in the first stage and a high voltage NPN in the output stage. Negative feed-back from output collector to input emitter produces an amplifier with low output impedance and high input impedance, and with the required bandwidth without any compensating inductor.

This arrangement ensures a linear transfer characteristic with excellent stability, making it also possible to take advantage of the stage gain for the 5.5MHz sound sub-carrier.

A pair of tuned circuits in the collector of the video output stage combine to provide an infinite rejection type of trap to prevent the 5.5MHz sub-carrier reaching the cathode - ray tube; the second of these circuits serves as the tuned input circuit of the 5.5-MHz sound amplifier.

Potential dividers between collector and ground feed the sync. pulse separator and the AGC gate. This latter arrangement ensures that, provided the transmitting station transmits the correct sync. to picture ratio, the black level will be held constant at the collector of the video output transistor.

A potentiometer connected between the collector and a DC balancing point serves as a contrast control with a range of 10dB. Adjustment of this control leaves the sound, AGC and sync. pulse unaffected.

A study of the characteristics of the various types of cathode-ray tubes likely to be used in the receiver showed that, with a final anode voltage of 20KV, the highest cathode drive vol-

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Chief Engineer, Pye Industries Ltd., Marrickville, N.S.W.

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tage which could be used without serious degradation of the picture quality was 50V peak to peak (picture and sync. pulse).

This is lower than estimates made elsewhere but, in this receiver, with the accurate transmission of the black level, very satisfactory pictures are obtained with the contrast turned back below this level. Thus, by limiting the video amplitude to the maximum which is necessary, the current in the output transistor is kept down and no heat sink is necessary.

In order that the amplitude of any noise pulses passed on to the AGC and sync. separator should not be too great, the tips of the sync. pulses are held fairly close to cut off in the video amplifier; the black level control (in the AGC circuit) sets this point. The opposite end of the signal, the peak white, is set by the bias on the first video amplifier, the difference between these two points, of course, being 50V.

One difficulty which occurs with negative modulation television systems when the black level is fully retained in the receiver is that, in the absence of a signal, with only random noise reaching the cathode ray tube, the brightness will exceed peak white by a few per cent. This is a rather undesirable situation and, in the T.23 circuit, a connection is made between the emitter of the gain-controlled IF stage and the base of the video output transistor.

Thus, in the absence of a signal, when no AGC is being applied to the IF, the emitter voltage falls and resets the white level via the video amplifier. An extra advantage of this scheme is that, in effect, it extends the range of the AGC, holding the sync. pulse tips closer to the video amplifier cutoff than would otherwise be the case when only weak signals and relatively high impulsive interference are present.

AUTOMATIC GAIN CONTROL

The range of gain control required is approximately 80dB; that is to say, the receiver should handle a signal strength change from 20uV to 200mV and the output level should not change by more than 3dB.

Since cross-modulation between two or more stations of approximately equal strength can occur if the mixer is overloaded, it follows that the IF gain reduction should not be too great. At the weak signal end of the range, signal-to-noise is the criterion and, therefore, AGC to the tuner, which would spoil S/N, should not operate until the IF gain control is complete.

The T.23 approach to this problem is to make the AGC loop gain to the tuner high compared with that of the IF.

Thus, by generating a large negative voltage at the AGC gate and by having a correspondingly large positive delay voltage to the tuner, the IF gain reduction is 24dB before the tuner delay operates and only 6dB afterwards. The tuner then contributes about a further 60dB, bringing the total to 90dB, which covers the requirement.

The AGC control voltage is produced in a transistor/diode gate, pulsed by the horizontal output stage. The diode is necessary to prevent the transistor being driven into collector saturation during the retrace. The parameters of this gate have been carefully adjusted to minimise the effects of impulsive noise.

A second transistor, connected as a grounded emitter with collector feedback, changes the sign of the control voltage and lowers the resistance to a value suitable for controlling the current in the IF amplifier. The tuner delay is set by a variable resistor in the base circuit of this second transistor.

SOUND CHANNEL

A single grounded-emitter transistor 5.5MHz amplifier limiter stage feeds the ratio detector, which feeds the triode-pentode audio stage via the volume control. Great care in the shielding of the 5.5MHz section is necessary to prevent radiation of harmonics which may cause patterning on some channels, particularly when a rod antenna is used.

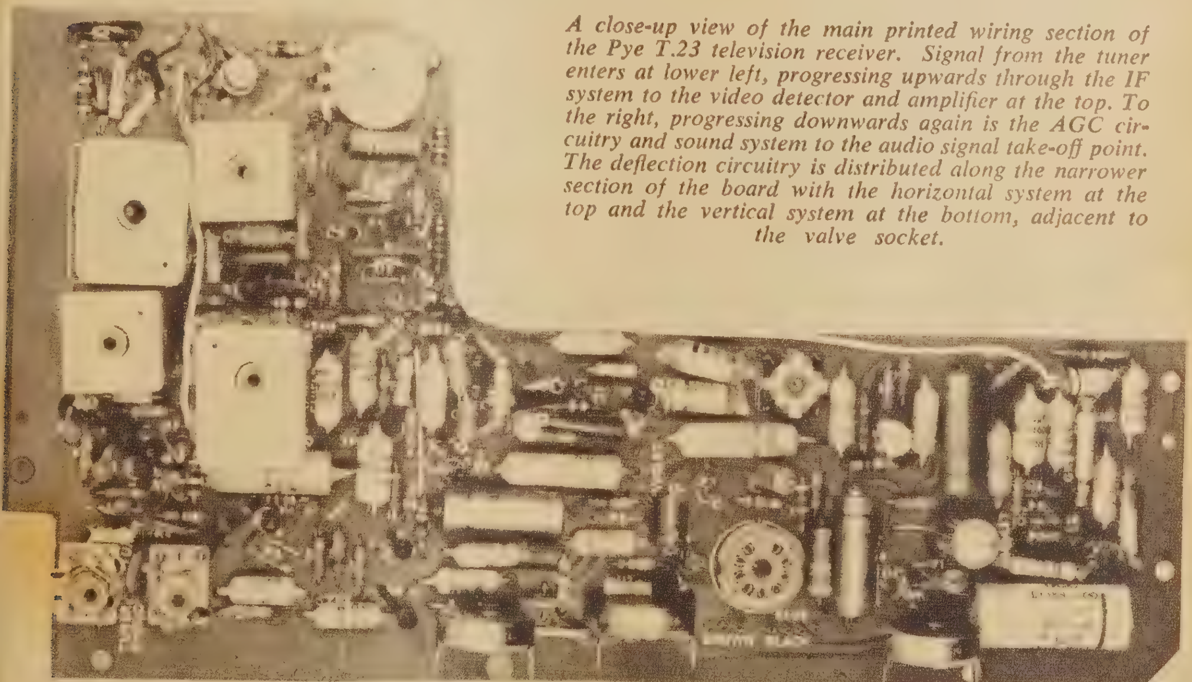
A high degree of negative feedback is used in the audio amplifier which delivers one watt into a 15-ohm loudspeaker. The output pentode is connected as a DC cathode follower to produce 20 volts at 30mA for the transistor HT supply.

The transistor sync. separator has a somewhat similar mode of operation to that of a triode valve separator but has a much better noise clipping characteristic.

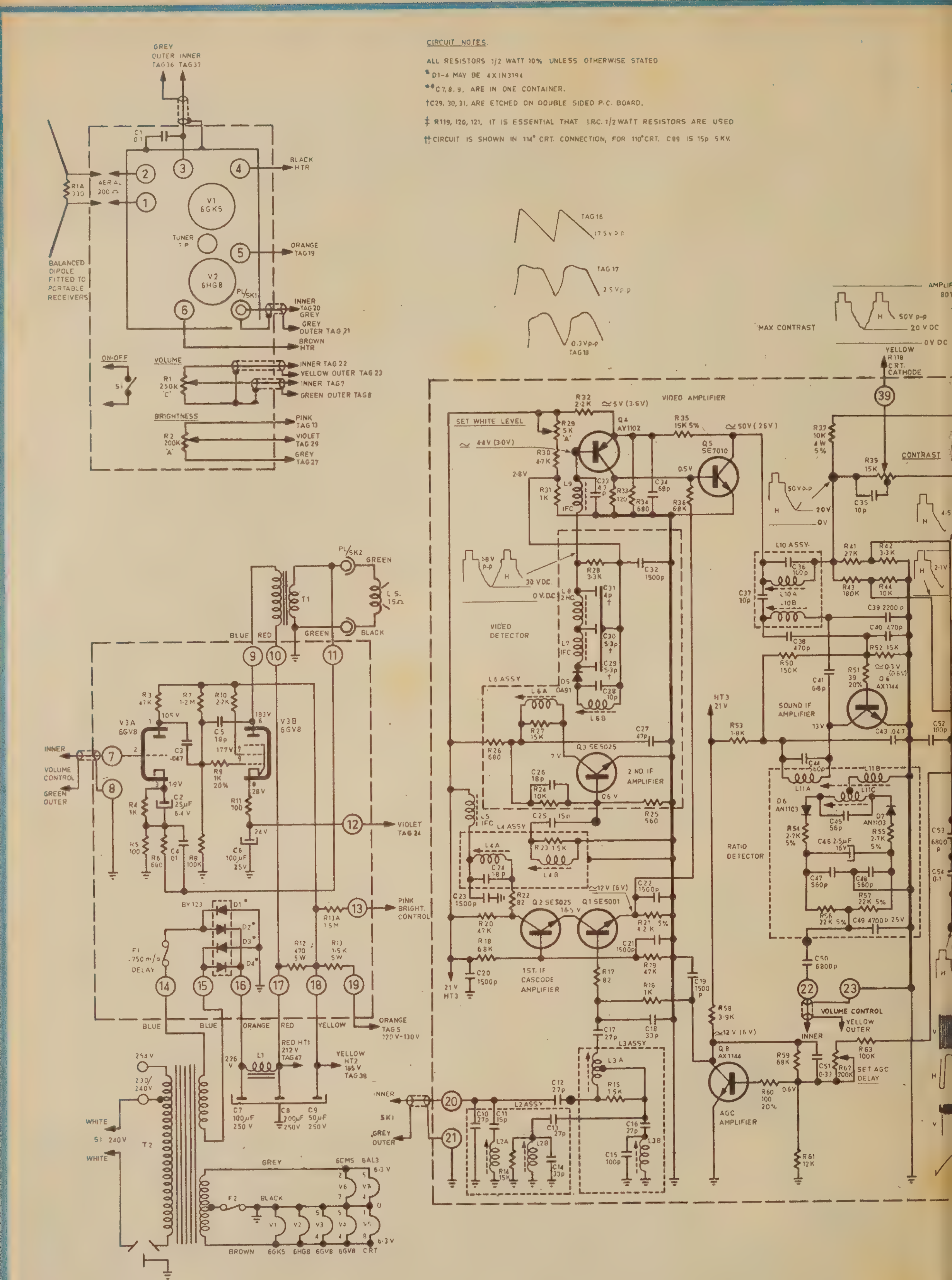
The vertical timebase employs one diode, one transistor and one triode-pentode valve. The transistor combines with the triode to form a multivibrator; the sawtooth voltage developed at the collector is directly connected to the grid of the output pentode, the anode of which is transformer-coupled to the toroidal deflection coils in the conventional fashion.

The synchronising arrangement is unconventional and is arranged so that an external hold control is not necessary. The method of operation is as follows:

A portion of the sync. wave train at the sync. separator collector is lightly integrated to make the vertical pulse stand proud. This waveform is then applied to a diode integrator, at the output of which a linear sawtooth is developed. This sawtooth is, in turn, applied to the grid of the triode, which amplifies, changes the sign, and im-



A close-up view of the main printed wiring section of the Pye T.23 television receiver. Signal from the tuner enters at lower left, progressing upwards through the IF system to the video detector and amplifier at the top. To the right, progressing downwards again is the AGC circuitry and sound system to the audio signal take-off point. The deflection circuitry is distributed along the narrower section of the board with the horizontal system at the top and the vertical system at the bottom, adjacent to the valve socket.



CIRCUIT NOTES.

ALL RESISTORS 1/2 WATT 10% UNLESS OTHERWISE STATED

* D1-4 MAY BE 4 X 1N3194

** C7, 8, 9, ARE IN ONE CONTAINER.

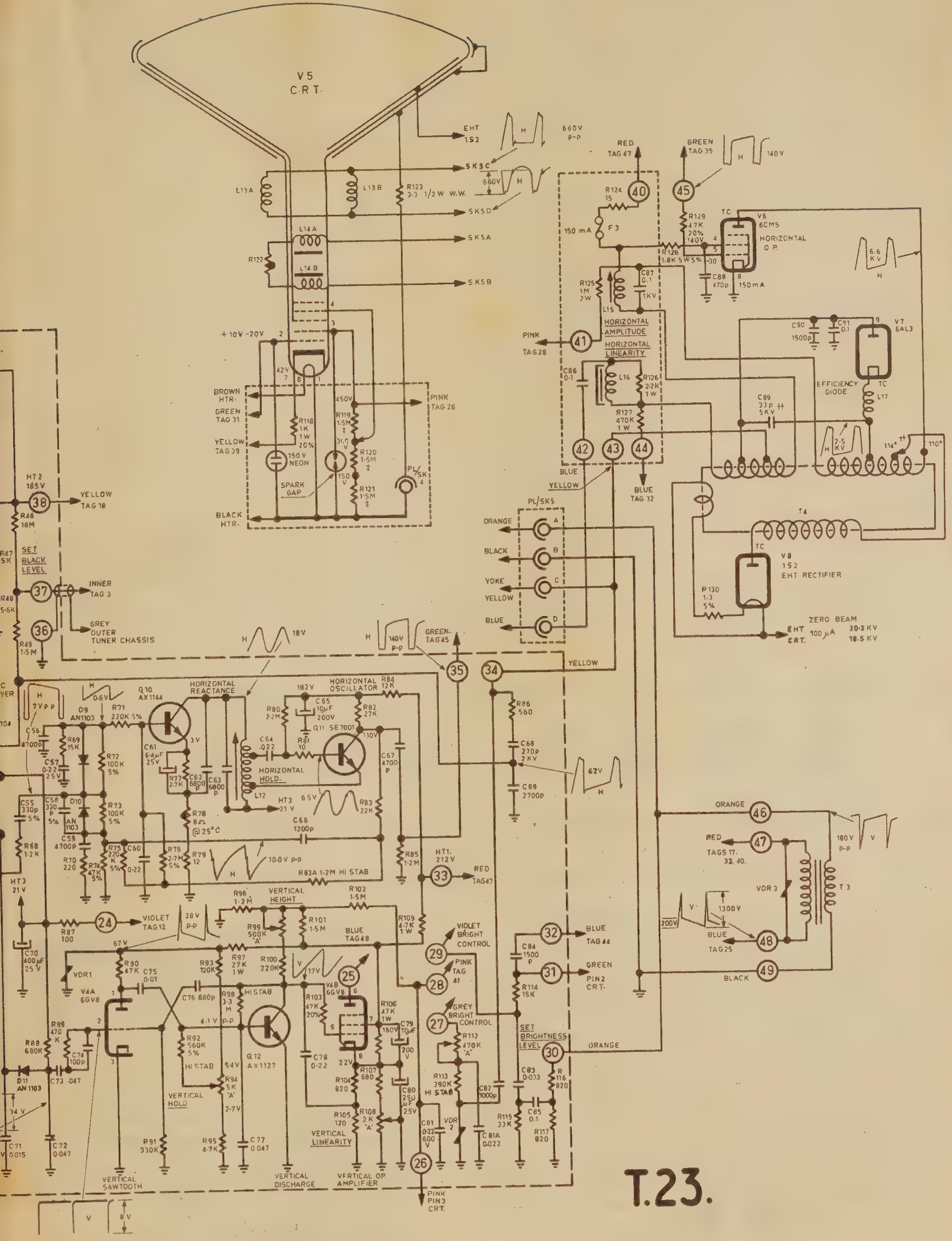
† C29, 30, 31, ARE ETCHED ON DOUBLE SIDED P.C. BOARD.

‡ R119, 120, 121, IT IS ESSENTIAL THAT I.R.C. 1/2 WATT RESISTORS ARE USED

†† CIRCUIT IS SHOWN IN 114° CRT. CONNECTION, FOR 110° CRT. C89 IS 15p 5KV.

GREY
OUTER INNER
TAG36 TAG37
C1 .01
R1A 330
AERIAL 300Ω
BALANCED DIPOLE FITTED TO PORTABLE RECEIVERS
V1 6GK5
TUNER T.P.
V2 6HG8
PL/SK1
BLACK HTR
ORANGE TAG19
INNER TAG 20 GREY
GREY OUTER TAG 21
BROWN HTR
ON-OFF
S1
VOLUME
R1 250K 'C'
INNER TAG 22
YELLOW OUTER TAG 23
INNER TAG 7
GREEN OUTER TAG 8
BRIGHTNESS
R2 200K 'A'
PINK TAG 13
VIOLET TAG 29
GREY TAG 27
TAG 16
17.5 V p.p
TAG 17
2.5 V p.p
0.3 Vp-p
TAG 18
MAX CONTRAST
50V p-p
20 V DC
0V DC
AMPLIF
80V
YELLOW
R118
CRT. CATHODE
PL/SK2
GREEN
T1
L.S. 15Ω
BLUE
RED
GREEN
BLACK
R3 47K
R7 1.2M
R10 2.2K
105 V
193 V
V3A 6GV8
V3B 6GV8
C3 .047
C5 18p
177 V
R9 1K 20%
INNER
VOLUME CONTROL
GREEN OUTER
1.9V
C2 25μF 6.4V
R4 1K
R5 100
R6 680
C4 .01
R8 100K
R11 100
28V
24V
C6 100μF 25V
VIOLET TAG 24
BY 123
D1
D2
D3
D4
R13A 1.5M
PINK BRIGHT. CONTROL
F1 .750 mA DELAY
R12 470 5W
R13 1.5K 5W
BLUE
BLUE
ORANGE
RED
YELLOW
ORANGE TAG 5 120V-130V
254 V
230/240V
226 V
L1
RED HT1 212 V TAG 47
YELLOW HT2 185 V TAG 38
C7 100μF 250V
C8 200μF 250V
C9 50μF 250V
WHITE
S1 240V
WHITE
T2
GREY
6CM5 BAL3
6.3 V
F2
BLACK
V6
V7
V1
V2
V3
V4
V5
BROWN
6GK5
6HG8
6GV8
6GV8
CRT
6.3 V
VIDEO AMPLIFIER
SET WHITE LEVEL
R32 2.2K
5V (3.6V)
R29 5K 'A'
Q4 AY1102
R35 15K 5%
50V (26V)
Q5 SE7010
4.4V (3.0V)
R30 4.7K
2.8V
R31 1K
L9 IFC
C33 4.7p
R33 120
R34 680
C34 68p
R36 6.8K
0.5V
R37 10K 4W 5%
R39 15K
CONTRAST
C35 10p
50V p-p
20V
0V
L10 ASSY.
C36 100p
L10A
L10B
C37 10p
R41 27K
R42 3.3K
R43 180K
R44 10K
C39 2200p
C40 470p
C38 470p
R50 150K
R52 15K
R51 39 20%
0.3V (0.6V)
Q6 AX1144
C41 6.8p
SOUND IF AMPLIFIER
13V
C43 .047
C52 100p
1.8V p-p
33 V DC.
0 V DC
R28 3.3K
C32 1500p
L8 2HC
C31 4p
VIDEO DETECTOR
L7 IFC
C30 5.3p
C29 5.3p
L6 ASSY
L6A
D5 OA91
C28 10p
L6B
HT3 21V
R53 1.8K
R27 15K
C27 47p
R26 680
Q3 SE5025
7V
2ND IF AMPLIFIER
C26 18p
R24 10K
6V
R25 560
C44 560p
L11A
L11B
L11C
D6 AN1103
D7 AN1103
C45 56p
R54 2.7K 5%
C46 2.5μF 16V
R55 2.7K 5%
RATIO DETECTOR
C53 6800p
C54 0.1
L5 IFC
L4 ASSY
C25 15p
R23 1.5K
L4A
C24 1.8p
L4B
C47 560p
C48 560p
R57 22K 5%
R56 22K 5%
C49 4700p 25V
12V (6V)
C22 1500p
C23 1500p
R22 82
Q2 SE5025
Q1 SE5001
16.5 V
R21 4.2K 5%
R20 47K
R18 68K
C21 1500p
C20 1500p
1ST. IF CASCODE AMPLIFIER
R19 47K
R17 82
R16 1K
C19 1500p
C50 6800p
21V HT3
VOLUME CONTROL
YELLOW OUTER
INNER
R58 3.9K
12 V (6 V)
Q8 AX1144
R59 68K
C51 0.33
R62 200K
R63 100K
SET AGC DELAY
C17 27p
C18 33p
L3 ASSY
L3A
R15 1.5K
C12 27p
INNER
SK1
GREY OUTER
L2 ASSY
C10 27p
C11 15p
C13 27p
L2A
L2B
R14 15K
C14 33p
C16 27p
L3B
C15 100p
0.6V
R60 100 20%
AGC AMPLIFIER
R61 12K
4.5
2.1V

Though fine detail has to suffer of necessity, because of the large order of reduction, we reproduce the complete schematic circuit of the new Pye T.23 television receiver. An interesting feature of the drawing is that its general layout follows closely the layout of the receiver itself, both in respect to the main printed wiring board and the position of the peripheral units. Thus the photograph on page 95 can be compared with the


V5
C.R.T.
EHT
1S2
660V
P-P
SK5C
SK5D
SK5A
SK5B
L13A
L13B
R123
3.3 1/2W W.W.
L14A
L14B
R122
+10V -20V
42V
450V
BROWN
HTR.
GREEN
TAG 31
YELLOW
TAG 39
R118
1K
1W
20%
R119
1.5M
R120
1.5M
R121
1.5M
150V
NEON
SPARK
GAP
PINK
TAG 26
PL/SK
BLACK
HTR.
RED
TAG 47
GREEN
TAG 35
140V
R124
15
F3
150 mA
R129
47K
20%
R128
1.8K 5W 5%
V6
6CM5
HORIZONTAL
O.P.
6.6
KV
C88
470p
150 mA
R125
1M
2W
L15
C87
0.1
1KV
HORIZONTAL
AMPLITUDE
HORIZONTAL
LINEARITY
PINK
TAG 28
C86
0.1
L16
R126
2.2K
1W
R127
470K
1W
C90
1500p
C91
0.1
V7
6AL3
EFFICIENCY
DIODE
L17
C89
33p
5KV
2.5
KV
114°
110°
BLUE
YELLOW
BLUE
TAG 32
PL/SK5
ORANGE
BLACK
YOKE
YELLOW
BLUE
T4
V8
1S2
EHT RECTIFIER
R130
1.3
5%
ZERO BEAM
EHT
CRT.
100 μA
20.3 KV
18.5 KV
HT2
185V
YELLOW
TAG 18
R46
18M
SET
BLACK
LEVEL
INNER
TAG 3
GREY
OUTER
TUNER CHASSIS
R49
1.5M
18V
GREEN
TAG 45
YELLOW
HORIZONTAL
REACTANCE
Q10
AX1144
HORIZONTAL
OSCILLATOR
R84
12K
182V
D9
AN1103
R71
220K 5%
R80
2.2M
C65
10μF
200V
R82
27K
Q11 SE7001
130V
C61
6.4μF
25V
C64
.022
R81
10
C67
4700
R86
560
C68
270p
2KV
C69
2700p
62V
R69
15K
R72
100K
5%
R77
2.7K
C62
6800
C63
6800
HORIZONTAL
HOLD
L12
HT3
21V
R83
22K
R73
100K
5%
D10
AN1103
C55
330p
5%
C58
330p
5%
C59
4700p
R78
8Ω
@25°C
C66
1200p
R68
1.2K
R70
220
R74
47K
5%
R75
220K
5%
C60
0.22
R76
2.7M
5%
R79
12
10.0V P-P
R83A 1.2M HI STAB
R85
1.2M
HT1
212V
RED
TAG 47
ORANGE
RED
TAGS 17,
33, 40.
180V
P-P
VDR3
T3
HT3
21V
VIOLET
TAG 12
28V
P-P
R87
100
R96
1.2M
VERTICAL
HEIGHT
R102
1.5M
R99
500K
R101
1.5M
BLUE
TAG 48
R109
4.7K
1W
VIOLET
BRIGHT
CONTROL
C84
1500
P
BLUE
TAG 44
GREEN
PIN 2
CRT.
200V
1300V
BLUE
TAG 25
BLACK
C70
400μF
25V
VDR1
67V
R90
47K
C75
0.01
R93
120K
R97
27K
1W
R100
220K
17V
V4B
6GV8
R114
15K
V4A
6GV8
C76 680p
R98
3.3
M
HI STAB
R103
47K
20%
R106
47K
1W
C79
10μF
160V
GREY
BRIGHT
CONTROL
R112
470K
SET
BRIGHTNESS
LEVEL
ORANGE
R89
470
K
C74
100p
R92
560K
5%
Q12
AX1127
R88
680K
D11
AN1103
C73 .047
HI STAB
VERTICAL
HOLD
R94
5K
R91
330K
R95
4.7K
C77
0.047
C78
0.22
22V
R104
820
R107
680
R105
120
R108
2K
C80
250
μF
25V
VERTICAL
LINEARITY
R113
390K
HI STAB
C82
1000p
C81
0.22
600V
VDR
2
C81A
0.022
C83
0.033
R115
33K
C85
0.1
R116
820
R117
820
C71
0.015
C72
0.047
VERTICAL
SAWTOOTH
VERTICAL
DISCHARGE
VERTICAL OP
AMPLIFIER
PINK
PIN 3
CRT.
8V

T.23.

contents of the printed wiring board, as depicted on the circuit above, and contained within the broken lines. We would stress that the circuit is reproduced purely to help readers familiarise themselves with hybrid circuit techniques. We have no plans to promote the home construction of receivers to the circuit, which calls for components specially designed to suit.

presses it on the base circuit of the discharge transistor.

Since the average value of the linear synchronising sawtooth is zero, it does not change the frequency of the time base unless the frequency is different from that of the sync. pulse. This means that a plus and minus pull-in range is achieved and the setting of the preset hold control is a simple matter of shorting the sync. and adjusting until a steady picture is obtained. The pull-in range has been adjusted to ±4Hz.

Because of the non-linear integrating process necessary to generate the synchronising sawtooth, this system is inherently resistant to impulsive noise and, in this regard, gives a performance similar to that of the horizontal flywheel circuit.

Two transistors and two diodes are used in the horizontal locked oscillator circuit. This design is similar to the previous valve design in as much as a sine-wave oscillator cum sawtooth drive generator is frequency controlled by a variable reactance stage, which is, in turn, locked by a double-diode discriminator.

Because of the disparity of the powers involved, it was necessary to use a complete ferrite shroud in order to provide a high degree of magnetic shielding of the oscillator coil and thereby prevent the field of the deflection coils interfering with the oscillator.

The inherently good noise performance of the time bases, coupled with the noise clipping characteristic of the video amplifier, make the addition of a noise inverter a doubtful necessity and this device has been omitted.

The horizontal output stage is basically similar to the earlier T.21 chassis but has several improvements. The anode is driven harder into the knee and the pentode/diode overlap has been increased. The developed EHT is up to 20KV and the regulation is improved. The rings at the start of scan have been reduced and the linearity is now excellent.

A physical improvement is that the EHT rectifier anode is plugged directly into the transformer, thereby eliminating the rather dangerous flying lead. The temperature rise in the transformer is extremely low by virtue of reduced flux density, the addition of an aluminium heat sink, and the positioning in the chassis below the valves.

CATHODE RAY TUBE

It seems that a certain amount of internal sparking in CRT's must be accepted. This is particularly the case in the first few hours of life and it may recur later if the receiver is transported and thereby shaking loose minute particles of phosphor, etc.

This sparking has led to a good deal of trouble in the past on valve receivers and is potentially more dangerous where transistors are used, since the voltage ratings are much lower. Therefore, some extra precautions are taken in the T.23. These precautions were worked out with the aid of a solenoid operated vacuum switch and are as follows:

1. The earthing of the aquadag is made as high an impedance as other requirements allow. It is not connected to any metal framework but returned to the tube socket via a small wire-wound resistor and a light gauge lead. Thus the peak current is limited when an internal spark occurs.

2. A small printed board mounted on the tube socket carries a 150-volt neon connected to G.1., and resistor type spark gaps are connected to G.2. and the focus electrode. The leads come well away from the transistor circuitry and are either bypassed or have high voltage stop-off resistors. The net result is that it is confidently expected that this design will be quite free from transistor failure due to sparking cathode-ray tubes.

CONTROLS

Apart from the channel selector, the only viewer controls that appear on the front of the receiver are volume ON/OFF and brightness, the preset contrast control being available at the rear. The range of the brightness control has been limited and the tolerances in circuit and CRT parameters are taken up by a factory preset adjustment.

POWER UNIT

The mains transformer has a lamination stack height of two-thirds that of the T.21 receiver. The HT voltage for the valves is 212 and 20-volt supply for the transistors is obtained from the cathode circuit of the audio output pentode.

Conclusion: Further transistorisation of TV receivers is now clearly desirable but the right types of power transistors at the right price are not yet available. It is likely that the next step will be a transistorised tuner but "crystal ball gazing" is not a very fruitful pastime. ▬

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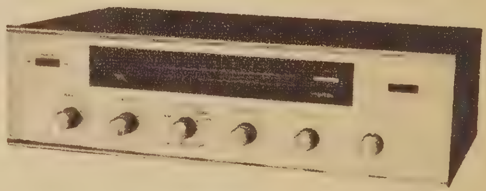

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A READER BUILT IT!

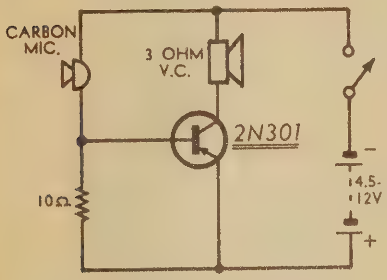
Circuits and devices which we have not actually tested in our laboratory but published for the general interest of beginners and experimenters.

ONE-TRANSISTOR P.A. SYSTEM

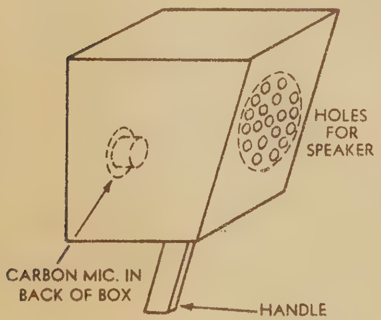
Dear Sir,

"I would like to bring before your notice a very simple circuit for the columns of 'A Reader Built It' in your magazine. I found the circuit in an old American magazine, so it is not mine, but it works so well that I thought it might be worth sending to you. The circuit is that of a loud hailer amplifier. It uses one transistor (power transistor, 2N301 or equivalent) and a few very minor parts.

"A carbon microphone is used and, because of this, it should be noted that the amplifier is built for reinforcement rather than quality reproduction of the sound.



Above, the circuit of the one-transistor P.A. and, below a method of construction.



"Parts placement is not critical, but the power transistor should be mounted, along with the 10-ohm ½-watt resistor, on a heat sink. The battery I used was a cycle lamp (4.5V) and it worked quite well, though better results can be obtained from higher voltage batteries, within the ratings of the transistor.

"The whole assembly can be mounted in a suitable wooden or metal box, and a handle under the box is well worth fitting. The box I built is as shown.

"At the top of the handle I mounted a trigger switch. This was one that I salvaged from an old wooden wall mounting telephone. When the receiver was hung up, on this model, the circuit was switched off but if the switch contacts are reversed, and the two prongs that hold the receiver removed with a hacksaw, then the switch is quite useful.

"Output from the model I built, using a 5-inch 3-ohm loudspeaker, was slightly under 250mW but, as mentioned earlier, better results are obtained from better voltages."

Yours faithfully,
N. T. Packer
(320 Maundrell Terrace, Aspley, Qld.)

EDITOR'S NOTE: Simple circuits along these lines were covered in our August, 1959, issue, but Mr Packer's letter will bring the idea before readers who may not have seen the earlier reference.

THERMISTOR MEASURES TEMPERATURE

Dear Sir,

"Measuring temperatures with an ordinary glass thermometer is not always a convenient procedure. With this thought in mind, I set out to find a simple and inexpensive means of making a temperature measuring device, which would read out the temperature on a meter.

"While measuring the resistance of a small thermistor of the glass enclosed variety (type number in the PMG is 1AN) I noticed that the resistance varied quite considerably with a small change in temperature; e.g. holding the glass stem between the fingers caused a sudden drop in resistance.

"Here are some of the resistance measurements in ohms at various temperatures: 40 deg. F—500,000; 60 deg. F—300,000; 100 deg. F—150,000; 400 deg. F approx.—400 (on my meter only!) The important thing was that the relationship of temperature to current was substantially linear, as far as the meter was concerned!

"Connecting the thermistor in a simple circuit as shown allowed me to measure temperatures successfully down to 20 deg F.

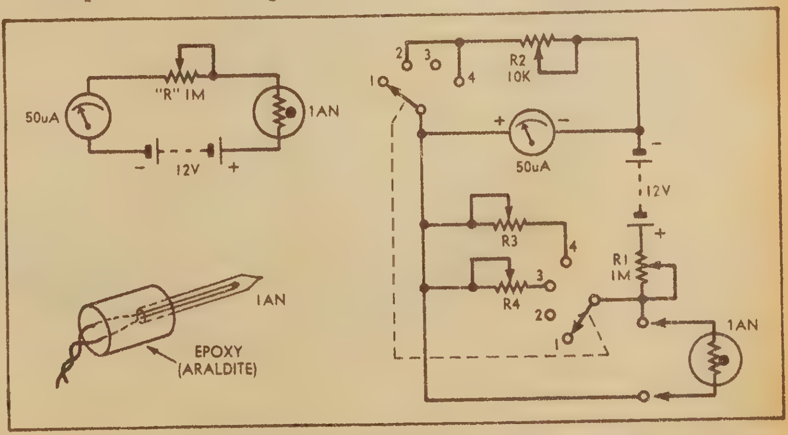
"The setting-up procedure can be summarised as follows:

1. Immerse the 1AN into a liquid at a temperature of 40 deg. F.
2. Adjust the variable resistance R1 until the meter reads exactly 20uA. Call this reading 40 deg F (20uA x 2).
3. Raise the temperature of the liquid to 60 deg. F; the meter should now read 30uA.
4. Increase the temperature of the liquid to 100 deg. F; the meter should now read 50uA.
5. Shunt the meter with a 10K pot and, with the liquid temperature unchanged, adjust the pot so that the meter reads 25uA. The full-scale reading will be 200 deg. F.
6. By adding extra switch positions, drawn as 3 and 4, and introducing extra resistors drawn as R3 and R4, the meter can be made to read other temperature ranges.

"Here are a few suggestions for its use: Measuring the temperature from various locations at a central point; monitoring the temperature of electronic equipment, while in use; fire alarms.

"To judge by the small amount of information about thermistors given in textbooks, one would think they had just been invented! The meter I used is a 4in square imported type, costs about $6."

Yours faithfully, A. Sallur
(72 Pitt St, St. James Park, W.A.)



If only somebody could develop a transistor that didn't need neutralising...

We'd all have something to smile about!

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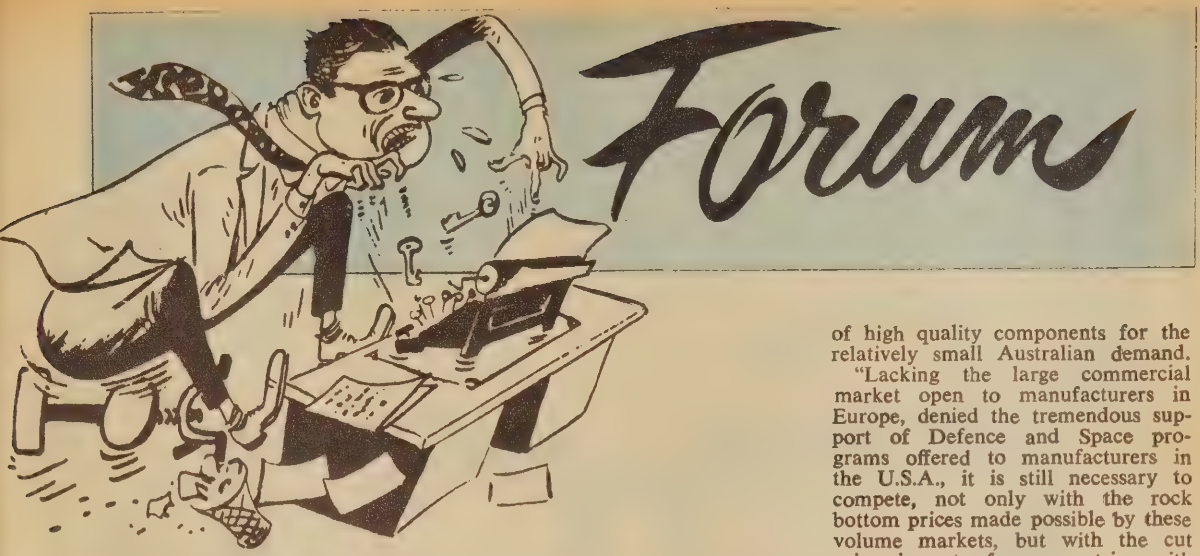

Quality of components

In our October issue, a correspondent from Lyons, A.C.T., had some hard things to say about the quality of electronic components manufactured in Australia. He stated, as his opinion, that the industry is so deeply conditioned for the entertainment and communications market that it cannot cope with demands for higher quality, higher precision and higher standards of ruggedness.

Conducted by the Editor

One might have expected a fairly vigorous reaction to such provocative remarks, but it has been left to one company to reply. We quote the letter in full:

Dear Sir,

"In the October issue, your correspondent, K.S., called upon local industry to pay more attention to the reliability, not only of circuit design, but also of components and construction.

"Speaking on behalf of International Resistance Company (Australasia) Pty. Limited, the largest manufacturer of resistive components in the southern hemisphere, we feel that K.S. deserves to be congratulated for turning the spot light on a very important aspect of the electronics industry.

"Apparently we have been at fault in not making better use of mass communication media and in placing too much emphasis on the dissemination of technical information by way of direct mailing. We will certainly re-examine this policy.

"However, we cannot agree with K.S. when he suggests that the Australian electronic components manufacturers are not very concerned about reliability. We at IRC have always accepted the serious responsibility for the quality and reliability of our Australian-made products. Proof of our sincerity in this regard is our Electronic and Chemical Research and Development Laboratories and the Group Testing Facility, requiring an original outlay of some $250,000 several years ago and a subsequent expenditure of approximately $25,000 per annum.

"The Test Facility, a section of which incorporates a laboratory approved by the National Association of Testing Authorities, plus an extensive quality control establishment monitoring personnel, material and methods, has gained IRC the rather coveted title of Approved Firm from the Quality Control Branch of the Department of Supply.

"As for Armed Services' Approval Certificates, at the date of writing, IRC (Aust.) holds certificates for carbon composition resistors (five types), deposited carbon high stability resistors (nine types) and vitreous enamelled and other wire wound resistors (eight types) and more are under consideration.

"It is of interest to note that IRC (Aust.) was allocated the first code number MYA in the Australian catalogue of approved manufacturers issued by the Department of Supply and was supplying approved resistors to the Armed Services during World War II.

"Not only are component approvals difficult to obtain but, once given, can only be retained by exhibiting high standards of technical skills and ruthless attention to quality. Persons not actually engaged in manufacturing electronic components cannot be expected to appreciate the heavy cost of high quality, nor to stop and wonder how we, a wholly Australian owned and operated company, without the aid of overseas capital, can contemplate producing an ever widening range of high quality components for the relatively small Australian demand.

"Lacking the large commercial market open to manufacturers in Europe, denied the tremendous support of Defence and Space programs offered to manufacturers in the U.S.A., it is still necessary to compete, not only with the rock bottom prices made possible by these volume markets, but with the cut price imports from countries with low living standards.

"Nevertheless, while there are people like K.S. to critically evaluate Australian versus overseas standards, to force us to be dissatisfied with simply maintaining our present position and to urge us on to even higher levels, we are confident we can continue to meet these challenges.

"Such objective criticism must be beneficial to the whole electronics industry, especially if it goes hand in hand with the habit of expecting, demanding, and purchasing Australian quality components, thereby developing a sturdy industry capable of generous contribution to the economic stability and self-sufficiency of the Australian nation.

"Next time K.S. is in Sydney, we would welcome him as a visitor and it would be our pleasure to show him our manufacturing plant and quality control facilities."

Yours faithfully,
Lloyd H. McCulloch
(Sales Manager).

Changing the subject, another reader's comments on the "Reader Built It" item from the same issue—a light-operated automatic stop for high quality record players. He points out that there is a much easier way to meet the requirement for the Labcraft turntable and many readers may be interested to note this.

On the other hand, while we registered some initial dismay at the complexity of the suggested transistorised gadget, we realised on second thoughts that many might find it intriguing. And, no less important, such a device can prove its usefulness over such a long period, that first cost is soon lost sight of.

Anyway, here's the letter:

Dear Sir,

"The article on page 79 of the October issue of your magazine, 'PHOTO-CELL TURNTABLE STOP,' prompts me to bring to your attention the, apparently, little-known fact that an automatic stop does exist for the ALL BALANCE/LABCRAFT combination.

"This switch is the JOBO Automatic Viscosity Switch and is sold by

A significant breakthrough in silicon planar technology has finally solved the designer's dilemma of how to utilise available device gain and still maintain circuit stability in high-frequency linear amplifiers.

Conventional silicon and germanium transistors suffer the disadvantage that their inherent feedback capacitance makes it necessary to individually neutralise each stage to obtain circuit stability, which results in a reduction of overall gain. This problem has now been solved by the development of the "Miniwatt" silicon planar transistors BF167 and BF173 which employ a unique construction technique—integrated screening*—to achieve feedback capacitances of such a low order that the need for neutralisation is entirely eliminated.

The marked superiority of the BF167 and BF173 is evidenced by the extremely low feedback capacitance (Cre=0.150 pF for the BF167 and 0.230 pF for the BF173) and their invariant maximum stable power gain (figure of merit) of 2560 and 2640. (Conventional silicon planar transistors recommended for RF/IF applications have typical Cre's of 1.0 pF and comparative figures of merit of 300 to 1000.)

The BF167, designed for forward gain controlled stages features a very wide control range (60 dB). The BF173 has an epitaxial structure resulting in a low collector saturation voltage and is capable of supplying high output voltages in output stages where power handling capability is of paramount importance. Both transistors have high cut-off frequencies (BF167—350 Mc/s and BF173—550 Mc/s) hence good linearity is obtained over a wide bandwidth.

Typical applications include Television I.F. amplifiers, wideband Radar I.F. amplifiers and premium performance F.M.—I.F. and R.F. Service. The new transistors, typical of the Miniwatt range—both consumer and professional—are encapsulated in hermetically sealed metal envelopes (TO—18) to comfortably withstand temperature and humidity problems common to our climatic conditions.

For data on the BF167 and BF173 and on Australia's largest range of semiconductor devices contact Australia's largest semiconductor manufacturer.

*Details of the Integrated Screening technique are described in the July, 1966, issue of the "MINIWATT DIGEST."

ELECTRONICS DIVISION OF PHILIPS ELECTRICAL PTY. LTD. *"Miniwatt"*

38.4737

G.R.D., importers of the Labcraft, switch is made in Holland, has no wiping contacts, trips at end of record, so places no drag on the arm and will trip at 1gm or more.

"I have fitted half a dozen (the first took some considerable time) but have found that if fitted to a plate, instead of to the turnable base it is easy enough. Also the 'trip' on the fixed part of the switch is upside down, don't ask me why, and another piece of brass has to be soldered in reverse direction to make it work. However, once fitted, it never gives any trouble. Last price to me from G.R.D. was $4.60, including sales tax.

Yours faithfully,
C.N. (Griffith, N.S.W.)

RE "WHEN IS A TRANSMITTER?"

I am writing about some of my experiences with needless interference to radio reception.

In your editorial in March, 1964, you suggested that, as a matter of urgency, the Postmaster-General should look into "the ridiculous legal situation which confers upon P.M.G. officers full authority over radio transmitters but little or none over devices which transmit radio."

NOTHING has been done! The bit about it in the telephone directories and the Post Office Guide is only a waste of space for it is just about meaningless. The P.M.G. Department is still powerless to help.

During 1965, when the fluorescent streets lights in this area were on, a severe and somewhat variable sound was audible, spread mainly across the middle of the broadcast band from about 3LO to 3KZ.

When I contacted the P.M.G. Department, their officer did not seem to realise that fluorescent street lights could cause QRM and seemed quite unconvinced by my detailed observations. I even had a diagram of the location of the most severe QRM sources, as observed from a car radio.

The noise has since diminished and has been heard only once recently.

However, early in 1966, very severe TV radiations began from a house two doors down the road. The noise is far greater than from a set in my own home and which was cured by lining the cabinet with bronze wire and fitting a couple of capacitors.

Two P.M.G. officers inspected the offending TV set and experimented with a filter and earth wire. These reduce the radiations and they suggested that the owner have similar devices fitted, but nothing has been done. Now it appears that another TV set has been moved into the area, which is every bit as bad as the first, 2UW, 1110, and 2HD, 1140, being particularly affected.

Apparently some TV manufacturers don't care about these spurious radiations.

Surely there should be some limit to the amount of radiation permissible, not only from TV receivers, but from other electrical appliances as well.

I, like others I know, enjoy popular music but not the presentation style of the Melbourne pop stations. I prefer 2UW but, needless QRM has made it unlistenable at the times I am best able to enjoy it.

I also like brass band music, but the attitude of the P.M.G. officers is that I have no right to expect it from distant stations—even though no Melbourne station carries a band program. Even 3GL is not a "local" to P.M.G. officers.

Then again, the only way to get country football scores is usually to listen to stations from within the area.

The P.M.G. say that they cannot do anything legally about interference and they are only interested, anyway, in local station reception. Nor are they able, or inclined, to do anything about assisting shortwave reception.

Could not "ELECTRONICS Australia" do something to help in this problem? Something definitely needs to be done to stir the Government into some kind of action to get the menace stopped!

I.S. (Glen Iris, Vic.).

On this page, we reproduce a letter —or at least portion of a letter—from I. S. in Glen Iris, Victoria.

Because he is interested in listening to stations outside his immediate area, he is troubled by interference from various sources, but notably from mains wiring and television receivers.

His complaints have served to emphasise two points:

(1) The P.M.G. Department and its officers appear to have no real jurisdiction over sources of radio frequency interference, unless the interference is caused by a piece of wireless transmitting equipment, identifiable as such under the Wireless Telegraphy Act.

(2) They will nevertheless do their best to help in an "unofficial" kind of way, but only if the interference is severe enough to affect radio or television reception from stations intended to serve the area in question.

We have drawn attention to (1) on previous occasions and the best thing we can do to help is probably to keep on drawing to it such attention. The situation is not the fault of the P.M.G. Department, for they simply do not have the legal power or the manpower to do more than they are doing at present.

In fact, in past years, P.M.G. officers have told me privately that they have had to put up with interference into their own communication channels from RF heating and other sources which they knew all about!

The interference question is one which can only be finally resolved by Federal Parliamentary legislation.

And maybe that's a lot simpler than it sounds. The Wireless Telegraphy Act is as out of date and inadequate as its name. The whole thing needs re-framing. "Wireless Telegraphy" indeed, in an age of television!

As for the question of listening only to local stations, it sounds logical enough on the surface. Maybe it's expecting too much to hold the interference down to the level of the era before every second device was electrically operated.

But the argument would be a lot more convincing if the interference were really being held to a level, economically justified and legally enforced.

As it is, the noise ambient is all the time creeping up and, with it, the cost of maintaining reliable communication from point A to point B.

Nor can we lay all the blame on the "other fellow." Just to mention one pertinent point: Local car manufacturers fit their vehicles with noise-reducing ignition leads but think how many times we receive the advice to "chuck those things out and stick in proper wire!"

Changing the subject yet again, there is still a trickle of letters from readers who do not like the term "Hertz" as a replacement for "cycles per second." While we do not want the matter to become wearisome, we do not want to give the impression, either, that readers' opinions are worthy only to be ignored.

Points raised in these letters are as follow:

(1) The fact that Hertz has been current for years in Europe, and is now spreading to U.S.A., is no reason for its adoption in Australia. Instead of simply going along, "ELECTRONICS Australia" should try to reverse the trend.

(2) Hertz is just one of many "undesirable" changes, Oersted and Gilbert, for example, being promoted as replacements for older and suitably descriptive terms.

(3) Cycles per second is used in other sciences, for example in connection with metal fatigue. Are these sciences expected to change their terminology?

(4) The significance of shortened forms and abbreviations is not as great as it has been made out to be.

(5) Is not the real motive of "ELECTRONICS Australia," in adopting the term Hertz, one of snob appeal, to keep in line with the glossy expensive overseas journals?

(6) Would not efforts to "clean up" and "standardise" the content of the magazine be more appropriately directed towards better printing, whiter paper, etc?

(7) Be Australian, use cps, not Hertz!

All this is heavily reminiscent of the arguments which raged in my younger days about the "new-fangled" idea of defining the position of radio stations in the spectrum in terms of frequency rather than wavelength. To generations who had grown up with "metres" and developed their relevant scale of reference, the idea of talking in "kilocycles" seemed unnecessary and difficult. And, in fact, it was a lot more difficult than the change under present discussion. It was not just the change of a word but a whole new set of figures which related to the earlier set only by dividing into 300,000!

But, even in the present era of cycles, kilocycles, megacycles and gigacycles,

(Continued on page 189)

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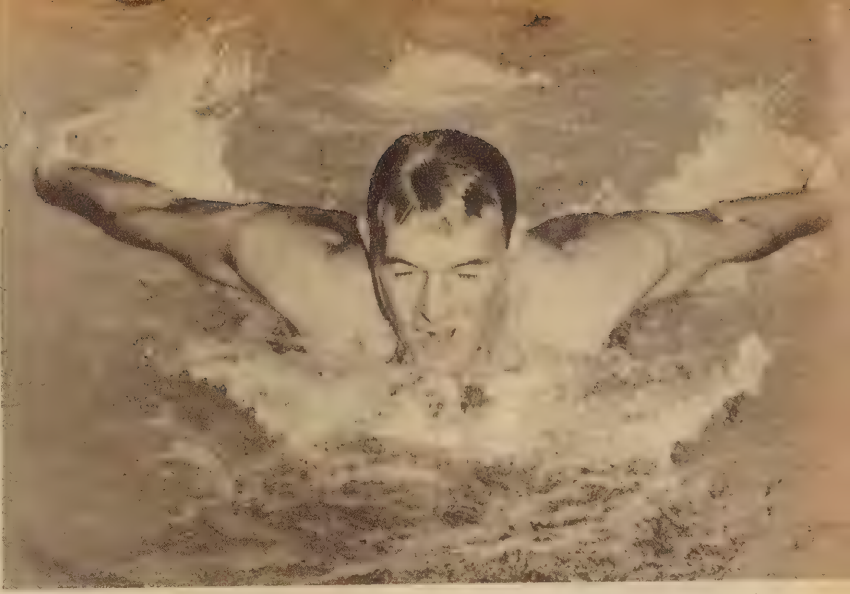
SCOPE

Electronic Flash

A number of ancillary matters are discussed in this month's article, including battery charging and chargers and a thyristor trigger circuit to protect camera contacts. The latter will appeal particularly to professional photographers.



What electronic flash can do. This picture was taken by the author using last month's prototype unit. The butterfly exponent is Brian Wilkinson, Olympic Games representative (Melbourne 1956) and Empire Games Gold Medallist (Cardiff 1958).

By Philip Watson

An essential requirement for our electronic flash unit is some form of battery charger and, as mentioned last month, a suitable socket has been provided on the unit to permit the charger to be plugged into the battery with a minimum of effort.

There is not a great deal to such a charger, but those points which govern its design are worth considering. First, it has to satisfy two basic requirements as far as the battery is concerned, (a) to fully charge the battery in the shortest possible time—consistent with safety—and (b) to provide a trickle charge on a full-time basis once the battery is charged, to offset internal losses and ensure that the battery is always at full capacity and ready for use.

As far as the owner is concerned, it should be simple to use, so that the battery is given the right treatment almost automatically but, at the same time, it should not use any more components than are strictly necessary in order to keep the cost at a reasonable level.

Thus, while it would be possible to design a charger which would automatically adjust itself to the battery's requirements at all times, this would necessarily be a relatively complex arrangement. For the time being at least, we felt that a simpler arrangement, providing two charge rates selected manually according to a simple rule, would suit the majority of readers.

The manufacturers recommend constant current charging as the safest arrangement for a nickel-cadmium battery, and this also has the advantage that it is relatively easy to provide. The simple basis to is start with a source of charging voltage considerably higher than necessary, then add resistance until the required current value is obtained. With its own high value of internal resistance, the charger becomes relatively insensitive to changes in the effective resistance of the external circuit.

In practice an AC supply of about 30 volts, plus a simple half-wave rectifier and the necessary series resistance, works out very well and will supply nearly constant current over the full charging cycle. A two position switch selects either the "FULL" or "TRICKLE" condition.

In adjusting any charging circuit for use with nickel-cadmium cells the major requirement is to ensure that the 10-hour charging rate is not exceeded when the battery is fully charged. Even if a so-called constant current circuit falls somewhat short of this ideal, allowing the battery to charge at a somewhat higher rate when it is well discharged, no harm will result provided the charge drops to the 10-hour rate at the completion of the charge.

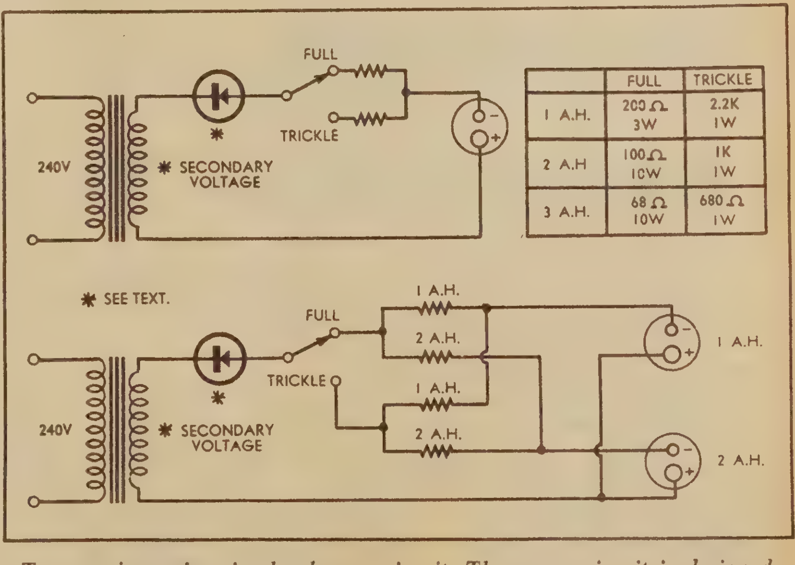
Similarly, no harm will result if the battery is left on charge, at this rate, for relatively long periods, i.e., several days, after the battery has reached full charge. Thus, if in doubt about the battery's condition, it is better to overcharge.

To keep the battery in a fully charged condition until the next time it is required, a trickle charge rate somewhere between the 100-hour rate and 50-hour rate is recommended. This may be continued indefinitely.

Relating these figures to practical conditions, a 1AH battery should be charged at 100mA for 14 hours to fully charge it, after which it may be kept in good condition with a trickle charge of about 10mA. For a 2AH battery these figures become 200mA and 20mA, and for 3AH, 300mA and 30mA.

In practice, considering the kind of service involved with the flash unit, it is likely that the battery will be only partly discharged on most occasions, in which case it will be sufficient to charge it overnight, i.e., 8 to 10 hours, which will still provide a small margin of overcharge for good measure.

In fact, this forms the basis for a simple rule on which to base the battery's care: Charge overnight at the "FULL" rate, then switch to "TRICKLE" until the battery is used again. If the battery has been fully



	FULL	TRICKLE
1 A.H.	200 Ω 3W	2.2K 1W
2 A.H	100 Ω 10W	1K 1W
3 A.H.	68 Ω 10W	680 Ω 1W

Two versions of a simple charger circuit. The upper circuit is designed to charge a single battery, for which the resistors are selected to suit. The lower circuit will charge two batteries, of differing capacity if necessary.

NEW IMPROVED 30 WATT

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No. 598—Complete Kit of parts to smallest screw. $57. No. 656 — Wired ready to operate, $60. Freight extra. Size: 6in w. x 3in h. x 8½in d. Weight 6½lb.

ELECTRONIC FLASH

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Steel chassis, plated No. 649	$ 2.50
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Wired and tested, No. 471D, extra $5.00. Freight extra. Write for blueprint list of parts.

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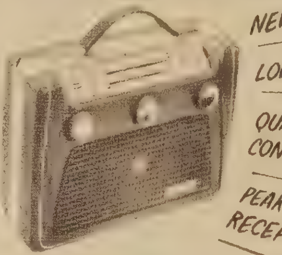

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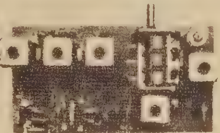

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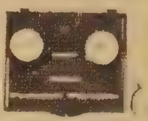

1 TRANSISTOR—1 DIODE

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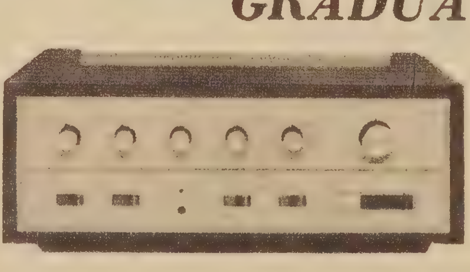

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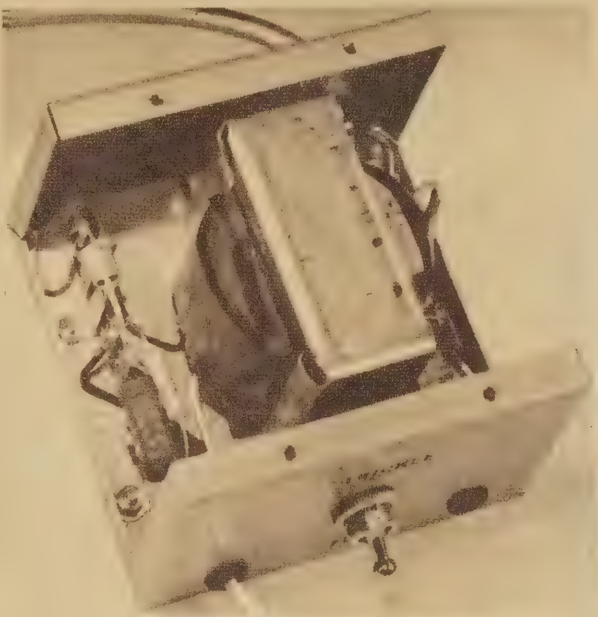
discharged add another 12 hours at the "FULL" rate.

Coming to the more practical side, we were fortunate in being able to obtain, "off the shelf" a 30V, 600mA transformer which is a standard line with at least one manufacturer. It was originally designed for our December, 1964, TV Receiver (to power the tuner drive motor). It is physically small, relatively inexpensive, and should be readily available.



The finished charger in its simpler form, i.e., for charging a single battery. Where more than one battery is involved, or a single large battery, some ventilation should be provided in the region of the tag strip. A row of ¼in holes, with a corresponding group in the lid above, should do the job.

This transformer, although rated at a nominal 30V, delivers a somewhat higher voltage than this on light load. This appears to be due to the fact that it was designed to deliver a fairly heavy current on an intermittent basis and must deliver the specified 30V under these conditions. In fact, this is all to the good since it brings the charger closer to the constant current ideal.

The rectifier may be any one of a wide variety of silicon types currently available. The main requirement is a Peak Inverse Voltage (PIV) rating of 75 volts or higher and a current rating at least equal to the likely maximum charge rate under any conditions.

Typical types would be the Mullard or Philips OA610 (100V PIV), OA620 (200V), or the OA210 (400V). All these are rated at 500mA which should be more than adequate, and the only difference is the price, which increases with the PIV. However, even the OA210 is quite moderately priced. It may also be the most readily available.

The case is the same as that used for our car battery charger described in May of this year. It measures 4in x 4in x 2½in and is quite large enough to house the transformer and the few small components involved. A good idea of the layout can be obtained from the accompanying photograph.

The series resistors for both charge rates will have to be selected according to the size of battery used in the flash unit, and suggested values for 1AH, 2AH and 3AH types are given in the circuit. However, it would be a good idea to check these with a meter if one is available.

In this regard, the following point concerning the behaviour of the popular moving coil-meter when measuring rectified current should be noted. Where half-wave rectification is employed, a moving coil current meter will read only .636 of the RMS current. Thus, to set the system for 100 mA, the meter should read 63.6mA.

The circuit as shown is intended to provide a single function device, designed to suit a particular battery, and this approach goes a long way toward making a simple, near foolproof system. However, it could happen that a particular user may have more than one battery for use with his flash unit and, more importantly, batteries of different size.

It is quite conceivable, for example, that a 1AH battery which appears to be adequate initially, may have to be supplemented later by, say, a 2AH type, both batteries being kept available for use if necessary. In this event, the charger should be capable of handling both batteries.

PARTS LIST

1 Case 4in x 4in x 2½in.
1 Transformer. Pri. 240V, sec. 30V approx. (see text). Ferguson PF2228 or similar.
1 Rectifier. Type OA610, OA620, OA210, or similar. (See text).
1 200 ohm, 3W resistor (1AH), 100 ohm, 10W (2AH). 68 ohm 10W (3AH).
1 2.2K, 1W resistor (1AH). 1K 1W (2AH). 680 ohm 1W (3AH).
1 2-position toggle switch.
1 3-lug, 5-lug, 6-lug tagstrip, length of 3-core mains flex and plug, length of 2-core polarised figure-of-eight flex for charging lead, 1 2-pin plug, 4 rubber feet, 3 grommets, nuts, bolts, washers, strap for mains flex, solder, hook-up wire.

The most satisfactory arrangement appears to be simply to fit two output leads from the charger, one for each battery. Each should be fitted with a similar two pin polarised plug, and each marked according to the size battery it is in-

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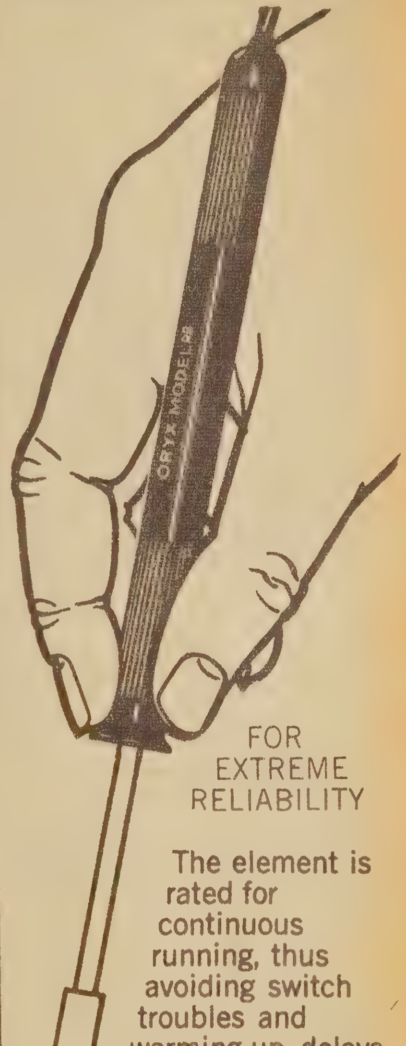

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tended to charge. Internally, each pair of output leads is wired to its own resistor network, appropriate to the battery size involved. This is shown in the accompanying circuit.

It will be fairly obvious that this arrangement will permit only one mode of operation at a time, i.e., either "FULL" or "TRICKLE" for both batteries, but not "FULL for one and "TRICKLE" for the other. However, this is unlikely to create too many problems.

It also means that, to some extent, the two batteries are connected in parallel with one another, whereas parallel connection of nickel-cadmium batteries is emphatically not recommended by the makers. However, considering the relatively large amount of resistance in circuit between the batteries they should be well enough isolated not to present any problem.

This twin battery facility need not be built into the charger immediately. It may be made up, initially, to suit a single battery, the extra circuitry being added if and when a second battery is acquired.

One point to watch if a second charging circuit is fitted, or even where a single 3AH battery is involved, is the dissipation of the dropping resistors in the "FULL" charge circuits. These will get quite warm, and some form of ventilation should be provided.

The best scheme seems to be to drill about four ¼in holes under the tag strip, with a similar pattern in the lid directly above it. Four rubber feet should be fitted to raise the box clear of the bench and allow a free flow of air. The two feet on the side where the holes are drilled may need to be set back from the edge by about one inch.

A final suggestion for the two-lead arrangement is to provide a dummy two-pin socket on the front of the charger, into which may be plugged any lead which happens to be unused. This will avoid any risks of short circuit involving a live naked plug.

Another method of battery charging is worthy of consideration, if only because of its simplicity. This is from a car battery (12V) and requires only a plug to fit the flash unit, a series resistor, and a plug to fit the car's cigarette lighter or other suitable outlet socket.

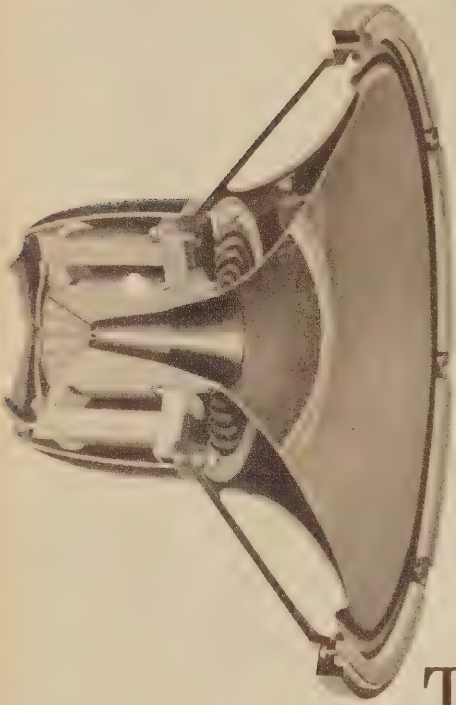
This arrangement is not suggested as a substitute for the mains supply, but rather as an addition to it. It could be useful in any circumstances where a mains outlet was not available or convenient to use. Nature photographers camped away from civilisation is one example, while professional photographers, travelling from one assignment to another, could put back at least some of the energy used for the previous job.

As before, the governing factor in selecting the series resistor is the charge rate for a fully charged battery, which should not exceed the 10-hour rate. In arriving at this, it must be remembered that the voltage of a car's electrical system is normally somewhat higher than the nominal 12 volts.

As a basis for experiment we suggest a 60 ohm resistor for a 1AH battery, 30 ohms for a 2AH battery, and 20 ohms for 3AH. A 3-watt wire wound resistor would be adequate in all cases.

In verifying charging current from the DC source, the figure would be as read on an ordinary moving coil meter.

A desirable feature in any flash system



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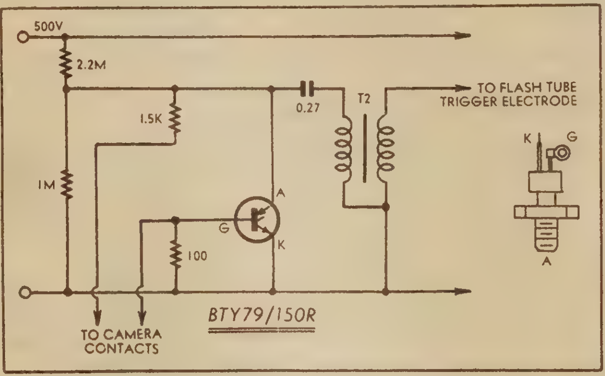
—electronic or expendable bulb—is that t not unduly tax the camera contacts. Unfortunately, by their very nature, both impose a fairly severe load on these contacts and it is more or less nevitable that these will give trouble eventually, if they are not periodically serviced. For this reason, anything which will lighten this load is well worth considering.

It should perhaps be emphasised that the electronic flash trigger circuit is not necessarily "harder" on contacts than the expendable bulb, but it is almost certainly true that the owner of an electronic flash unit will make many more exposures by this means than he would if he were forced to use expendable bulbs. So, in this sense at least, there is more justification for contact protection when electronic flash is used.

One of the most satisfactory ways of providing this protection is to interpose a thyristor or Silicon Controlled Rectifier (SCR) between the contacts and the trigger circuit. In very broad terms the thyristor is a three-terminal unit similar to a transistor, in that it is a solid state device, but with characteristics more like the thermionic device called a thyratron.



The trigger circuit modified by the addition of a thyristor. The additions are simple, involving only two half watt resistors in addition to the thyristor. The circuit reduces the contact current from several amps to about 25 milliamps.

The three terminals are the anode (connecting to the positive side of the system), the cathode (to the negative side), and the "gate." Assuming the gate to be disconnected for the moment, the application of voltage between the anode and cathode will result in virtually no current flow, apart from a very small leakage current.

However, the application of a small positive voltage to the gate electrode (relative to the cathode) will result in the anode-cathode circuit suddenly changing from a virtual open circuit to a very low resistance path. What is more important, due to a regenerative effect within the thyristor structure, this low resistance path remains after the voltage has been removed from the gate electrode. To restore the open circuit condition it is normally necessary to reduce the cathode-anode current to a very low value.

(A more detailed explanation of the thyristor was given in the October issue, in the series, "Keeping Up With Semiconductors.")

Having digested this explanation, look at the modified trigger circuit shown here. The thyristor is connected between the 0.27uF capacitor and the negative line in exactly the same position previously occupied by the camera contacts.

In the "at rest" condition, the thyristor gate is returned to the cathode via a 100-ohm resistor, putting it at essentially cathode potential. Under these conditions, the thyristor presents an open circuit between anode and cathode, similar to the open circuit camera contacts prior to firing.

The camera contacts now form part of the gate circuit so that, when they are closed, the gate is connected to a point on the divider network composed of the 2.2M, 1.5K and 100-ohm resistors. This point is a few volts positive with respect to the thyristor cathode.

Under these conditions the thyristor "fires" or changes abruptly from non-conduction to the conducting state. The 0.27uF capacitor now discharges through the trigger transformer primary circuit exactly as before, firing the flash.

The important point about all this is that the camera contacts are now required to handle only the gate current, something between 25 and 50mA, as compared with several amps with the normal circuitry. Under the new conditions it would be reasonable to expect the contacts to have an almost indefinite life.

Fitting the thyristor and the few extra components does not present any serious problems, and the individual can make his own decisions about the purely physical arrangements. The thyristor terminal connections are shown on the circuit.

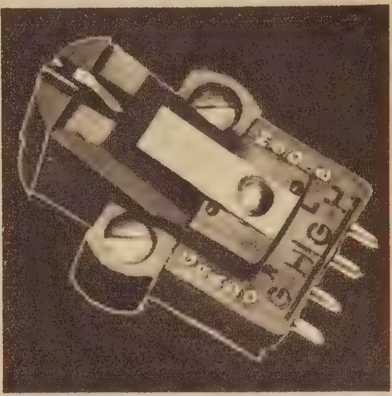
However, there is one aspect of the circuit which should be noted. The camera contact terminals are now both above "earth" (if we take this as being the negative rail) compared with the previous arrangement where one of these connected directly to the negative rail. Since cameras invariably have one contact connected to frame, some precautions are necessary to ensure that we do not finish up with unwanted voltages between different parts of the system.

The main requirement is to ensure that no part of the electrical system, either low voltage or high voltage, connects to the metal frame of either the carrying case or the flash head. In most respects this does not present a problem and, in fact, the system was built on the assumption that this would not be necessary.

The only real problem concerns the main storage capacitors. In common with most metal can electrolytic capacitors these exhibit considerable leakage between the negative electrode and the can. While this can be ignored with the conventional trigger circuit it could lead to minor complications with the thyris-

(Continued on Page 190)

GRADO



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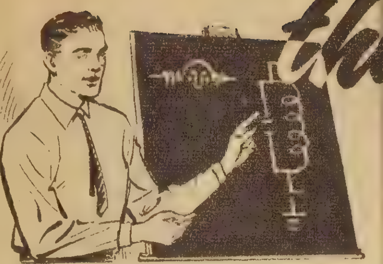

the "Answer Man" Explains

Why vertical transmitting towers?

The first question, we suspect, comes from an old-timer who cut his technical teeth on a bakelite panel and kept a scrap book of early radio stations.

Why do all the broadcasting stations, these days, use vertical transmitting towers? In the early days they all seemed to go in for two masts and a horizontal wire.

We'd probably have to search the archives for a documented answer to this question, but we imagine that most stations adopted a pair of masts and a horizontal wire aerial, because it seemed the logical thing to do.

Those were the days, you might remember, when radio enthusiasts were very distance-conscious. Listeners would spend endless hours patiently turning across the band, so that they could boast about the stations they had managed to tune in.

And station managers and engineers were just as keen on these long-distance reports. If a Brisbane station could be heard in Perth, it seemed proof apparent that it was putting a signal into all points in between!

What did it matter if the signal faded badly in some areas? It could be heard in between fades and that was the important thing!

In the course of time, as the novelty of radio wore off, listeners and station operators alike bothered a good deal less about DX reports.

In fact, station operators began to realise that signal energy heading into the ionosphere and landing interstate, was energy that would serve a better purpose if it could be directed into the station's intended service area. It would provide more people within that area with an interference-free signal.

With this kind of thinking came the further realisation that fading and distortion near the limits of the ground wave were related to the amount of energy, radiated upwards by stations, being reflected to earth and interacting with the ground wave. It was logical to assume that the problem would be alleviated if more signal could be concentrated along the ground and less radiated up into the ionosphere.

Yet another good reason for this kind of thinking became apparent as the number of stations in Australasia began to multiply, filling all available channels and leading to the necessity for some actually to share frequencies. If they were not to suffer intolerable mutual interference, their signals had to be restrained from skipping madly across the continent.

To put it into more technical terms, it became a matter of lowering the angle of radiation from transmitting aerials, so that a maximum amount of signal energy would travel along the ground, and a minimum be radiated upwards. This would mean the maximum amount of signal available in each station's service area, to overcome static and electrical noise, and a reduction in the reflected signal, which was likely to cause fading and mutual interference between stations.

As you might have guessed, this has led to the adoption of single vertical masts, which exhibit the desired low angle of signal radiation. In fact, a large amount of technical literature is devoted to the design of vertical radiators, their height relative to the transmitted wavelength, top-loading structures to conserve height, where this is a problem, methods of feeding them with RF energy and, of course, their physical design and support.

In fact, the idea of aerial directivity has been carried a step further by some stations in Australia. In addition to achieving a lower angle of radiation (vertical directivity) they are employing multiple towers, suitably spaced and fed, so that they obtain a measure of horizontal directivity. This is being used, typically, to redirect into a coastal city RF signal which would otherwise be radiated to little purpose over the adjacent ocean.

In other cases, horizontal directivity is being used to minimise radiation, towards each other, from stations sharing the one frequency. This allows them to provide a powerful local signal without creating an interference problem with the second station.

In short, there are very good reasons for the present style of broadcast transmitting aerial.

* * *

I traced scratching noises in my wideband radio tuner to intermittent contact between the metallic sarking in my house and a down-pipe to do with the hot water service. Is intermittent contact between the strips of sarking in modern homes a frequent source of radio noise and, if so, shouldn't it be bonded somehow when installed? The job of bonding it afterwards is a nasty one.

In fact, this question is not often raised by our readers but this is not to say that some haven't encountered trouble with it, without realising it is to blame.

It seems more or less self-evident that a large area of metallic foil, incorporated in a building for heat insulation, must have an effect on the strength of radio signals inside the enclosed area. It would not necessarily block the ingress of radio signals but it would certainly affect their strength and distribution.

This being so, it follows that the metal foil will have an effect particularly on radio and television receivers within the dwelling which are operating on indoor aerials — whether these are

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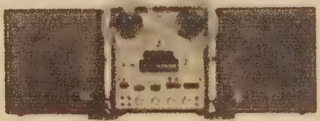

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High Compliance tweeters

FT-502

SPECIFICATIONS
Size : 50 mm (2 in.)
†Impedance : 8 or 16 Ω
Frequency Range : 2,000～20,000 c/s
Sensitivity : 100 dB
Power : 30 W max., 8 W nom.
Dimensions : 82×82 mm, 29 mm depth
Magnet Weight : 193 g (6.81 oz), Ceramic
Weight : 615 g (1⅜ lbs)

High Compliance woofers

FW-162

SPECIFICATIONS
Size : 160 mm (6½ in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 40～50 c/s
Frequency Range : f_0～2,000 c/s
Sensitivity : 97 dB
Power : 30 W max., 10 W nom.
Dimensions : 166×166 mm
81.6 mm depth
Magnet Weight : 500 g (1⅛ lbs), Ceramic
Weight : 1,660 g (3 11/16 lbs)

FW-202

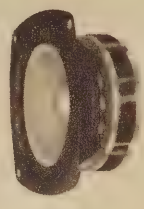
SPECIFICATIONS
Size : 200 mm (8 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 30～40 c/s
Frequency Range : f_0～2,000 c/s
Sensitivity : 98 dB
Power : 45 W max., 15 W nom.
Dimensions : 208×208 mm
90.8 mm depth
Magnet Weight : 830 g (1 13/16 lbs), Ceramic
Weight : 2,760 g (6 1/16 lbs)

Double-cone speakers

PW-65A

Size : 160 mm (6½ in.)
*Impedance : 8 Ω
Resonant Frequency (f_0) : 70～100 c/s
Frequency Range : f_0～15,000 c/s
Sensitivity : 97 dB
Power : 6 W max., 5 W nom.
Dimensions : 164.9 ⌀mm, 86.2 mm depth
Magnet Weight : 77.6 g (2.73 oz)
Weight : 476 g (1 1/16 lbs)

High Compliance wide range speakers



FE-103

Size : 100 mm (4 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 65～95 c/s
Frequency Range : f_0～18,000 c/s
Sensitivity : 96 dB
Power : 5 W max., 3 W nom.
Dimensions : 105×105 mm, 46.6 mm depth
Magnet Weight : 193 g (6.81 oz), Ceramic
Weight : 630 g (1⅜ lbs)

FE-163

Size : 160 mm (6½ in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 40～60 c/s
Frequency Range : f_0～20,000 c/s
Sensitivity : 98 dB
Power : 10 W max., 5 W nom.
Dimensions : 166×166 mm, 73.7 mm depth
Magnet Weight : 398 g (14.04 oz), Ceramic
Weight : 1,260 g (2¾ lbs)

Coaxial speakers

FX-201

with horn tweeter

Size : 200 mm (8 in.)
*Impedance : 16 Ω
Resonant Frequency (f_0) : 45～75 c/s
Frequency Range : f_0～18,000 c/s
Sensitivity : 101 dB
Power : 10 W max., 5 W nom.
Dimensions : 206 ⌀mm, 137.5 mm depth
Magnet Weight : 240 g (8.46 oz)
Weight : 2,200 g (4⅞ lbs)

FX-200 G2

with 2½" tweeter

Size : 200 mm (8 in.)
*Impedance : 16 Ω
Resonant Frequency (f_0) : 45～75 c/s
Frequency Range : f_0～18,000 c/s
Sensitivity : 101 dB
Power : 10 W max., 5 W nom.
Dimensions : 206 ⌀mm, 140.7 mm depth
Magnet Weight : 234 g (8.21 oz)
Weight : 2,200 g (4⅞ lbs)

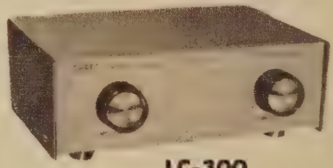
2-way network

LC-100

NETWORK
LC-100

Crossover Freq.: 2,500 or 3,500 c/s
Impedance : 16 Ω
Attenuation : 6 dB/oct.
Dimensions : 63.1 ⌀mm, 69 mm height
Weight : 280 g (9.88 oz)

2 or 3-way network



LC-300

Crossover Freq.: 350 or 700 c/s, 2,500 or 5,000 c/s
Impedance : 8 or 16 Ω
Attenuation : 6 dB/oct.
Dimensions : 83 H×200 W×134 mm D
Weight : 1,430 g (3⅛ lbs)

tweeter

FHT-1

FHT-1
†Impedance : 16 Ω
Frequency Range : 2,500～16,000 c/s
Sensitivity : 100 dB
Power : 10 W max., 5 W nom.
Dimensions : 110 mm height, 95 mm depth
Weight : 330 g (11.75 oz)

*at 400 c/s; †at 3,000 c/s

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devices that stand on the top of the cabinet, in-built aerials, pieces of wire hanging down the back or no apparent aerial at all!

If the situation is electrically stable — i.e. no intermittent contacts anywhere — the chances are that the occupier will merely observe that radio or TV reception inside the house is good, bad or indifferent, as the case may be, and act accordingly.

If the situation is not stable, he could have trouble — real trouble!

Actually, it calls to mind some of the problems which plagued radio listeners and servicemen in the early thirties, when the idea of using an outdoor aerial in the suburbs had gone out and automatic gain control circuits hadn't come in.

The receivers were left to gather what signal they could from within the house, via an aerial around the picture rail, and via the mains wiring. Complaints of "fading" were endless, nearly all of them caused by the changes in signal input level as electrical circuits were switched, modifying signal pickup from the mains and, to some extent the pattern of free-signal distribution around the dwelling.

Add to this a quota of partially earthed metal roofs, intermittently earthed guttering, stove vents, bath heater vents and other sundry metalwork and you have the picture.

All these things are still found in present-day houses, of course, but automatic gain control, which is almost universal in present-day receivers, smooths out most of the abrupt variations in signal strength. But it would not prevent intermittent signal conditions showing up as pops and scratches, as observed.

It would appear likely that the sarking would merely complicate the situation.

Should it be bonded and earthed? Most likely it should. Perhaps it is in some cases. Maybe bonding of a really permanent nature would be difficult to arrange.

In fact, this whole subject looks like a good one for "Forum" to discover readers' experience on a broad basis.

In the meantime, we could only be apprehensive from a radio point of view, about layers of metal foil which are simply laid in walls and ceilings without any forethought to their electrical situation.

A point that it does emphasise is that the interior of a dwelling is really not the best place to pick up signals for a radio or television receiver. The best place is usually in free space outside the dwelling and clear of all its sundry wiring and metal work.

* * *

Why are television antennas in country areas mounted vertically while antennas in the city are mounted horizontally?

A radio or television wave is an electro-magnetic radiation and has energy in an alternating electric field with which is associated an alternating magnetic field. The fields are mutually at right angles and they both progress in he direction of propagation of the composite electro-magnetic wave.

If the electric field associated with a elevision wave is parallel to the ground over which it propagates (the magnetic field being vertical) then the wave is said to be horizontally polarsed. It then follows that a vertically polarised wave has it's electric field in a direction vertical to the ground over which it propagates. It can be seen that the attitude to the ground, of the electric field determines the polarisation of the television wave.

Horizontally mounted antennas receive horizontally polarised waves, and vertically mounted antennas receive vertically polarised waves. In each case the sensitivity of an antenna to waves of the opposite polarisation is very much less than its sensitivity to waves having the polarisation for which it was designed.

In city areas where there is a considerable amount of man-made electrical interference it is possible to discriminate against or reduce the effect of this interference by employing horizontally polarised waves. This is due to the fact that a large proportion of man-made interference is predominantly vertically polarised. Hence in most city areas television antennas are horizontally mounted to receive the horizontally polarised transmissions.

In country areas where the television transmitters are far removed from some of the outlying towns which they serve, there is a possibility of co-channel interference; that is, two transmitters on the same channel intended to serve two different towns may have a similar signal strength at some third and far removed town. To overcome this situation one of the transmitters is usually vertically polarised.

Although this admittedly obviates the co-channel interference, experience within the industry seems to suggest that the use of vertical polarisation in practice tends to produce other problems. Among the more serious of these is a somewhat greater tendency toward ghosting. In some cases ghosting can be eliminated by antenna stacking but often a special antenna design is necessary.

A related but no less important problem is that vertically mounted antennas tend to present a larger surface area to wind, and must therefore be made from somewhat stouter material than the horizontally mounted type.

Although the problems associated with vertical polarisation are in most cases capable of solution, experience thus seems to suggest that quite expensive antennas can be required for good results. ■

Did you notice it?

On page 89, the advertisement for

THE BASIC
RADIO
COURSE

ERRATA, NOTES

STEREO P. A. AMPLIFIER, November, 1966. Parts list should be corrected to read: 2 4.7K ¼-watt resistors, 2 47K ½-watt resistors. Omit 2 220pF plastic or ceramic (not high K) capacitors. Circuit diagram values are correct.

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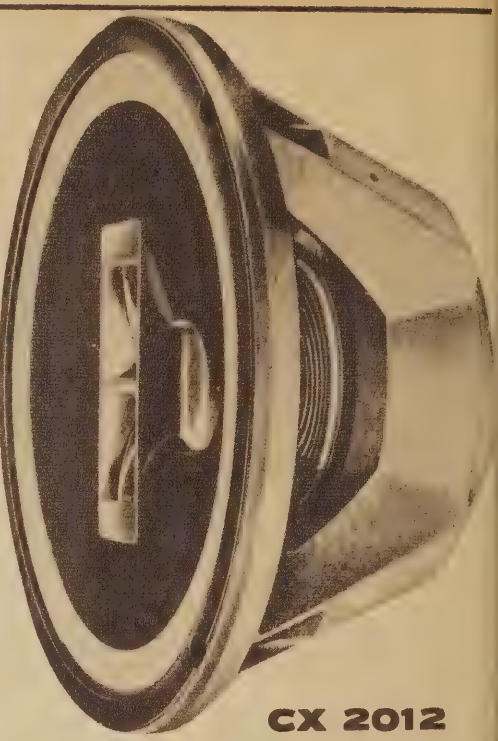
Highly respected for performance, Celestion speakers are advanced in design and engineering . . . these are the speakers overseas reviewers have given "rave" notices. Speakers of equivalent quality and similar price in the U.K. cost at least 50% more than Encel prices in Australia. Frequency response is conservatively quoted in the best British traditions.



CX 2012

DELUXE CX 2012 12" CO-AXIAL WIDE RANGE UNIT

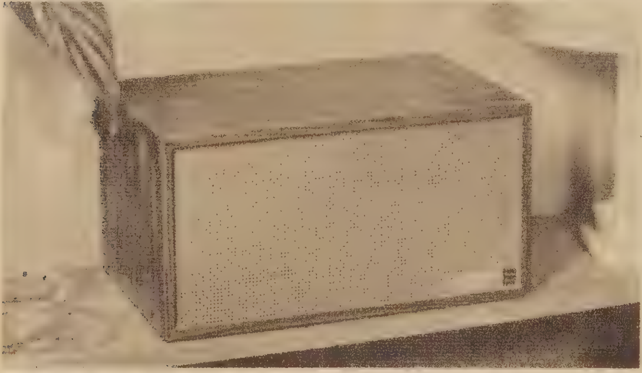
Very effective in a 2 or 3 cubic ft. enclosure, overall frequency response is 30-18,000 Hz. Power handling capacity is 20 watts R.M.S. Flux density—17,000 gauss . . . total flux 180,000 maxwells. The tweeter is co-axially mounted and an electrical cross-over provides smooth transition. Intermodulation is negligible **$59**

STANDARD CX 1512 12" CO-AXIAL WIDE RANGE

Very similar to the CX 2012, frequency response is 30-15,000 Hz, and power handling capacity 15 watts R.M.S. Crossover frequency is 4 kHz. Impedance . . . 15-16 ohms. Flux density is 13,000 gauss, total flux 88,000 maxwells. An outstanding, low priced high fidelity speaker **$39.50**

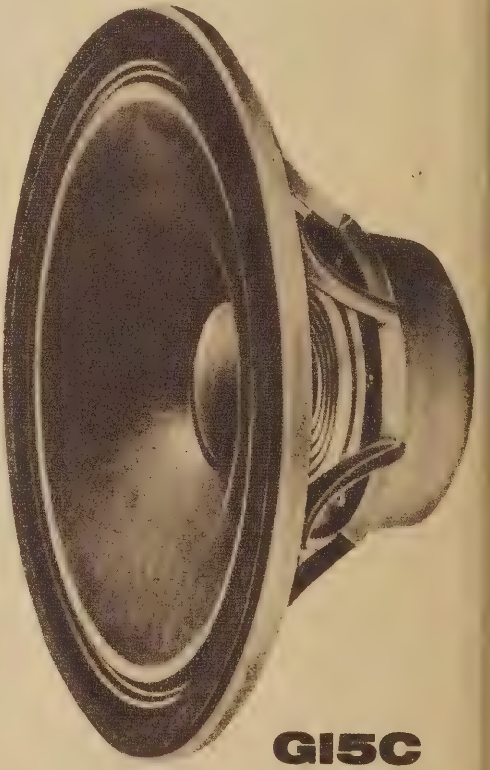
CELESTION HF 1300 HIGH FREQUENCY UNIT

This tweeter can improve treble performance with most speaker systems. Patterned on the well-known GEC BSC 1852 tweeter, frequency response is 1500 Hz. to 13 kHz. plus or minus 2 db and extends well over 15 kHz. Simply added to an existing speaker through a capacitor supplied free of charge **$15**



THE COMPACT CELESTION "DITTON 10"

Measuring only 12" x 6¾" x 8¼", the "Ditton 10" is regarded as the **most advanced compact high fidelity system available.** Read the reviews in "Hi-Fi News", page 433, October 1965 and the "Gramophone", page 41, June 1965. The latest models of this proven miniature enclosure are better than ever! Power handling capacity is 10 watts R.M.S. Separate bass and treble units. Available in walnut or teak **$59**



G15C

NEW "POWER RANGE" 15" and 18" MODELS

G15C. A 35 watts R.M.S. 15" speaker, this new Celestion unit has been designed for use with organs, guitars and public address systems. Feroba II ceramic magnet, total flux 180,000 maxwells. This powerful reproducer is Encel priced at only **$65**

G18C. The most powerful Celestion speaker made. Rated at 60 watts R.M.S. and with a total flux of 285,000 maxwells. Fundamental resonance 35 Hz. Voice coil diameter is 3". Ideal for electronic organs, electric guitars and public address systems. This 18" speaker is massive in every way but the price, and is used as standard equipment on the highest quality imported guitar amplifiers **$95**

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KEEPING UP WITH

semiconductors

. . . a short Glossary of Terms

DICE (singular DIE): Also called CHIPS or PELLETS. The tiny slivers of semi-conductor material constituting the actual "works" of a transistor or monolithic microcircuit. The name DIE apparently stems from the usual manufacturing process whereby scores or even hundreds of transistor or microcircuit configurations are first fabricated on a single convenient-sized WAFER of semiconductor, tested, and then scribed and cleaved ("diced") into individual chips or pellets. The dice/chips/pellets are finally mounted on HEADERS and either sealed in metal cans or ENCAPSULATED in a protective epoxy resin block.

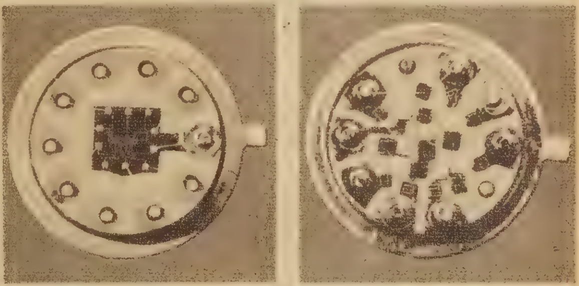
DOPING: The process whereby the characteristics of an intrinsic semi-conductor material are altered by the addition of relatively small quantities of selected impurity elements or compounds called DOPANTS. If the dopant atoms or molecules have more valency electrons than the intrinsic atoms, the resultant crystal will have electrons as the MAJORITY CARRIERS, and is termed N-TYPE semiconductor. On the other hand if the dopant atoms have fewer valency electrons than the intrinsic atoms, the resultant crystal will have holes as the majority carriers and is accordingly called P-TYPE. In both cases the conductivity of the material will be HIGHER than the intrinsic material, to a degree depending upon the DOPING LEVEL or quantity of dopant.

SUBSTRATE: The base or support layer of a transistor or monolithic microcircuit chip, usually constituting the major proportion of its volume. When composed of ceramic, glass or sapphire, the substrate functions mainly as a support and base during fabrication and subsequent mounting or encapsulation. When composed of heavily-doped silicon or germanium it has the additional function of providing a distributed low resistance connection to the collector or equivalent lowest-level elements.

EPITAXY (adj. EPITAXIAL) The process of forming at the outer surface of a semiconductor crystal a layer whose crystal structure is isomorphic with, and simply an extension of that of the original crystal. The layer may be formed either by growing additional material upon the original crystal, as in deposition, or by modifying the impurity levels as in diffusion. The word "epitaxial" is also used in a more restricted sense to distinguish between devices made from a semiconductor substrate formed by epitaxial growth of a low-conductivity lightly doped collector layer upon a high-conductivity heavily doped support-connection structure ("epitaxial devices"), and those made from a homogenous low-conductivity lightly doped semiconductor substrate ("non-epitaxial devices"). The word is apparently derived from the Greek words "epi" (upon) and "teinen" (arranged).

DEPOSITION: The technique of growing a semiconductor layer upon an existing crystal by depositing it directly from the heated vapour form or PHASE. The deposited or grown layer may be of either intrinsic or impurity semiconductor, independently of the existing crystal material. An impurity layer grown in this fashion has a relatively constant doping density throughout its thickness.

DIFFUSION: The technique of modifying the impurity concentration of the surface layer of a semiconductor crystal, by placing the heated crystal in a heated vapour of the appropriate impurity and allowing the impurity atoms to diffuse into the crystal. The resulting layer has a doping density which is not constant, but rather a rough EXPONENTIAL with highest density at the surface. The "gradient" of the exponential and the effective depth of the layer are controlled by varying the concentration of the impurity vapour and the allowed diffusion time.



Integrated microcircuit chips mounted on headers. At left, a monolithic chip; at right, a hybrid or "multi-chip" array.

PLANAR: A fabrication process developed in 1960 by Fairchild Semiconductor, in which the semiconductor chips are protected throughout the various fabrication steps by a thermally-grown layer of oxide. The oxide layer passivates all surfaces and junctions of the device against the environment, reducing surface leakage and breakdown-inducing defects to a very low minimum. In addition it is used as an area-defining pattern mask during the diffusion and deposition processes, being photolithographically etched to give areas of "transparency" where the areas are to be treated. The Planar process is restricted mainly to silicon, as it proves very difficult to arrange for a germanium oxide layer to be "opaque" to impurities. It is used with both epitaxial and non-epitaxial devices.

INTEGRATED CIRCUIT: Strictly, an integrated circuit is simply one in which all the components and wiring are grouped together in a single protective container or encapsulation. However the term is being used increasingly to refer to MICROMINIATURE integrated circuits, otherwise known as integrated microcircuits. When used in this sense it is usually taken to denote not only monolithic devices but also thin-film and hybrid devices. The words "integrated circuits" are often shortened to "integrateds" or "IC's."

MONOLITHIC CIRCUITS: Are circuits, usually microcircuits, in which all components and wiring are fabricated within a single chip of semiconductor crystal. Often referred to as "fully integrated" circuits. The term "monolithic" is derived from the Greek words "mono" (single) and "lithos" (stone), and thus means literally a "single stone."

THIN-FILM CIRCUITS: Are circuits, again usually microcircuits, in which the components and wiring are fabricated by deposition of thin films of metal, semiconductor and dielectric materials, generally upon an insulating substrate. The term "thin" is usually defined as implying a film thickness of 1 micron (microMetre) or less.

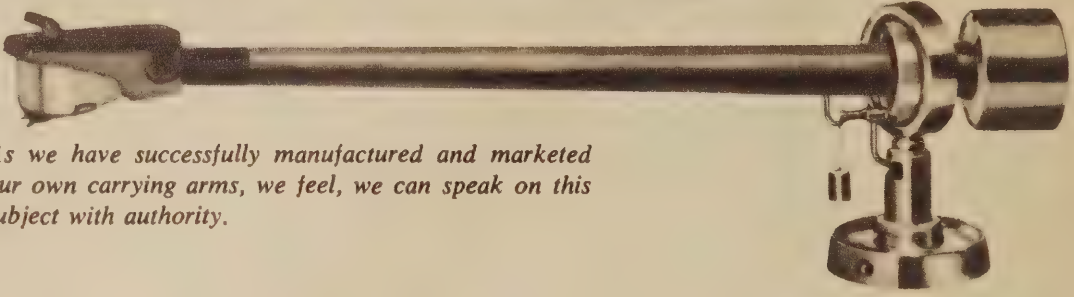
HYBRID CIRCUITS: Are strictly circuits or microcircuits which employ a mixture of fabrication techniques. In some contexts a hybrid microcircuit is one which consists of a number of monolithic subcircuits or devices mounted on a common header and with interconnections made using tiny wires (also called "multi-chip" IC's); in other contexts a hybrid microcircuit is one in which monolithic and thin-film techniques are used together in a unified complex fabrication technique. When monolithic subcircuits are bonded to a thin-film assembly of wiring and passive components, the name "flip-chip" is often used, although this is actually a trade mark registered by the Digital Equipment Corporation.

USEFUL REFERENCES for semiconductor fabrication techniques and applications include the following:

WARNER, R. M., and FORDEMWALT, J. N., **Integrated Circuits — Design Principles and Fabrication,** 1965. McGraw-Hill Book Co., Inc., New York.

LAISK, E., "Microminiature Circuits, Parts 1 and 2." In **Electronics Australia,** August-September 1965, V.27, Nos. 5 and 6. (J.R.)

WHY A TOP-QUALITY PICKUP ARM SHOULD BE MADE OF WOOD AND NOT OF METAL



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ADC.40 Pritchard Arm

Before introducing our JH Mk.I and Mk.II arms to the Australian market, pre-production models were made of aluminium and of specially treated hardwood. Admittedly, there was no difference between the models in regard to tracking ability, inertia, bearing friction and frequency response readings using the same cartridge. Yet, and a BIG YET it was, there was quite a noticeable difference in sound quality!

We claimed then: "The wooden body provides resonance damping properties resulting in a smooth, sweet instrumental timbre with a complete lack of false coloration." The fact, that many manufacturers of high quality arms have switched from metal to wood, speaks for itself, and there is no doubt that metal tends to "ring" and that some of this ringing gets transferred to the stylus resulting in unwanted signals that cannot be measured but heard. Consequently, one famous maker of a highly sophisticated and most expensive carrying arm employs a wooden insert inside the arm body. As experts agree, high quality sound reproduction is as much an art, as it is a science. In our opinion, it is more art than science.

Early in 1961 ADC introduced their now famous **WOODEN ADC.40 PRITCHARD ARM,** "which comes right at the top of the tree" to quote one leading audio equipment critic and to quote another one "has the lowest friction found in modern arms" or another one "is the most attractive American Arm available." Its secret is its extraordinarily low moment of inertia. It has to be as good as that, to be truly compatible with the outstanding ADC-10E cartridge, or, for that matter, any ADC cartridge. However, the most remarkable thing about this arm is, that, thanks to ADC's advanced technology, it is as modern today, as it was in 1961. No changes had to be made. You will remember what pick-up arms looked like five and a half years ago. Most of them were "blunderbusses" and completely useless for modern high-compliance, low tip mass cartridges, as we know them today and as the ADC-1 was in 1960!

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AUDIO TOPICS

THE RECORDING OF AN OPERA

Behind the scenes with the Boston Symphony Orchestra during the recording of "Lohengrin."

By Mary Campbell

For nearly an entire week Symphony Hall in Boston looked as though some bustling housewife had decided to clean the closets in her house, had put everything out all over the floor, and left it just like that!

The lobby was an untidy grove of potted artificial trees with white blooms, a few statues such as found around small pools, and superfluous maroon doors leaning on the walls, each marked for its proper place by a stuck-on piece of paper—"Mass Ave Side Centre Door Left Side."

Hallways were not better. Head-high fans turned the side halls into hot-air tunnels, and thick cables snaked along the floor. Inside the refined, elegant hall, tall plyboard strips rested on the floor and leaned against the first balcony, forming makeshift side walls. A huge, red, faded dropcloth hung from the back of the balcony, and another dropcloth covered a stage full of empty folding chairs. Seats in the orchestra section were missing all the way back to Row X.

But in that space of missing seats from Row X forward sat the Boston Symphony, in shirtsleeves, with their conductor Erich Leinsdorf facing them on a podium. Across the front of the stage, facing two microphones, stood four soloists from the Metropolitan Opera — a soprano with a heldentenor and a mezzo-soprano with a baritone.

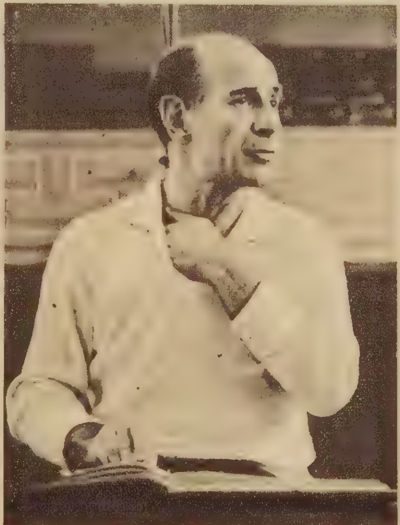
In the midst of apparent chaos and a few onlookers in the balcony, these artists knew exactly what they were doing and, ignoring their surroundings, they were expertly going about doing it. They were recording the full, uncut "Lohengrin," the first major opera to be recorded in America in several years (how many years depends on which of several modern operas recorded here are considered of major importance) and the first Wagnerian opera ever recorded in the country.

Herman D. Kenin, president of the American Federation of Musicians, found the occasion so auspicious that he came from Chicago on one of the six days of recording to listen. He made a brief speech congratulating RCA Victor and the participants on the undertaking, saying that he hoped the general argument for recording operas in Europe instead of America — that orchestral musicians are paid less in Europe—will be refuted by sales of made-in-America "Lohengrin."

Soprano Lucine Amara and tenor Sandor Konya, both with feet astride and firmly planted, stood facing a microphone at stage left — she with outstretched arms gracefully waving in time to the music, fingers crossed on both hands, and he with high hand pumping up and down, right hand in a fist, knit shirt pulled up to midchest, revealing an expanse of undershirt.

Although they stood side by side, they never looked at each other; they were completely intent on singing the opera's first love duet by Elsa and Lohengrin.

In the opera, beautiful, blonde Elsa is accused, on a riverbank, before a king, of having murdered her brother. Lohengrin, in silver armour, riding a boat pulled by a swan, arrives to say that he will fight Elsa's accuser, thus proving her innocent. And he will marry her—if she will trust him completely and never ask his name or origin. She promises, but soon after the marriage ceremony is enticed to ask the forbidden questions. Lohengrin then reveals that he is a knight of the Grail, who now must leave her, and the swan is her brother, who had been put under a spell.



Erich Leinsdorf, who conducted the Boston Symphony Orchestra for the full-length recording of the opera Lohengrin. Born in Vienna in 1912, Leinsdorf settled in America in 1937.

Recording an opera, like shooting a movie, is not done from beginning to end. "Lohengrin," whose three acts are divided into 11 scenes, was recorded by scene. Three hours in the afternoon and three in the evening were scheduled, Monday through Saturday — 36 hours of recording for a three-hour-and-45-minute opera.

When Miss Amara and Konya finish their duet, baritone William Dooley as Elsa's accuser, Telramund, and mezzo Rita Gorr, as Ortrud his wife, who later gets Elsa into trouble, begin to sing. They face a mike at stage right, since, on a stage at that moment, the two couples would not be near each other. On the stereo record, their voices will come from separate speakers. Jerome Hines also will be heard on the recording, as the king, and Calvin Marsh, as the king's herald.

The scene finished, conductor Leinsdorf settles back on the high red leather chair on his red felt-topped podium and turns to a little box on a tripod at his right side. The red light on the box goes out, indicating that sounds in Symphony Hall are no longer being recorded. Leinsdorf picks up a telephone, also on the box, to talk with Richard Mohr, RCA Victor's producer for the "Lohengrin" recording, whose background in opera record production extends back to work with Toscanini.

Mohr and Leinsdorf's musical assistant Andrew Raeburn have been sitting in the control room, simultaneously listening, poring over orchestral scores, conferring and making notes on the score to indicate why and how a certain passage has to be rerecorded.

Mohr says that measure 48A should be "a little softer in the harp part" and Leinsdorf tells the harpists they'll "play it with one harp instead of two." He also tells one instrumentalist that his "B flat is a little high in the fourth bar of 48B." They all get set to do it again, from the measure in the score marked "47" to the end of the scene.

However, it is clear that, over-all, "Lohengrin" is not being conducted by committee. Leinsdorf is definitely in charge. Once, stopping the music to correct a singer's tempo for the second time, he says, "I know you are singing it at the traditional tempo, but that is not what I consider the right tempo and

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ve are going to do it over until we get ; the way I say."

Only a linguist, however, could undertand all of the Vienna-born conductor's tatements. He speaks to Miss Amara nd Dooley, both Californians, in Engsh. She answers in English, and)ooley, who has done most of his singng for the past eight years in Germany, nswers in German. Leinsdorf speaks o Konya, who is Hungarian, in Gernan, and Konya answers in English. He peaks to Miss Gorr, who is Belgian, ometimes in German and sometimes in rench and she answers in English.

The soloists talk to each other in Engsh, except Miss Gorr and Dooley, who onverse in French. Leinsdorf is apt o speak a few words of Italian to his rchestra, chide them with "Now you now you don't understand German" vhen they laugh at one of Dooley's emarks and make himself the butt of is own joke when his heavily accented nglish is misunderstood and the orchesra starts playing in the wrong place n the score.

He says, "Thirty-eight . . . thirtyight. I'm going to take diction lessons. promise you, probably from Shakepeare in the park."

Finally, Leinsdorf calls a 20-minute reak and everybody scatters. Leinslorf and soloists climb to the back uptairs room, which serves as the control oom, to listen to the playback. There, mid piles of boxes of vinyl tape reels, wo technicians operate tape machines, ecording on 30in-per-second tape. A oll lasts 15 minutes. Most scenes to be ecorded run longer than that, so the econd man starts his machine before the irst has completely filled his tape.

An engineer has been sitting at a arge console watching pointers on dials hat indicate the sound level at each nicrophone and turning knobs to reguate the soundlevels and to mix or not nix sound for stereo separation.

During the playback, Leinsdorf nakes suggestions to the soloists. He ells Miss Amara that she sang a part f the score too passionately. When Richard Woitach, assistant conductor of he Metropolitan Opera, in Boston to ielp with the recording by conducting ff-stage musicians and coaching Miss Amara on her part, walks into the room, he explains, "I sang this too dark; I nust sing it more maidenly."

Before they go out to rehearse the ines, less passionately, with a piano, Miss Amara and Konya pose for photographers. "Don't be afraid to hold her," Miss Amara's manager tells Konya. And omebody makes a pun, "What do you vant him to be? A holdentenor?"

At break time, orchestra members night go to one of three rooms — a arge one behind the stage for tuning ip and practising, a hall-like space half flight down where concertmaster oseph Silverstein could be found with is violin resting against his lap and hest while he reached around it to play ards, and a basement room where a vaitress dispensed coffee and doughnuts.

The basement is otherwise stacked vith instrument cases and boxes for ravelling and a metal cabinet plastered vith the sign, "Happy Birthday, Beethoen."

Also during the breaks, the 14 aironditioning units are turned on to comat the late summer heat. These had een thrust, seven on each side, into oorjambs on the first balcony after the oors had been labelled and removed. The units could not operate during the recording, because of noise of the motors, but during breaks they ran at top speed, complete with hoses to drain condensed humidity into buckets in the halls and with powerful fans to blow the hot air down the corridors, away from the stage end and toward the back of the hall.

Listening to playback are (left to right) Sandor Konya, Lucine Amara, producer Richard Mohr, and musical director Erich Leinsdorf and his musical assistant, Andrew Raeburn. Dynagroove expert Jack Pfeiffer is in background.

The temperature in one of the business offices opening off a balcony hall registered 106 degrees F. one afternoon during a recording break.

Concertmaster Silberstein remembers a scientific test conducted one season on the Boston Symphony, which indicated that the orchestra's sound is best in the atmosphere of between 71 and 78 degrees F. Above 78, metal instruments tend to go sharp and, when humidity accompanies the heat, stringed instruments go flat.

Conscious of the optimum temperature, orchestra members kept a thermometer with them all during the recording. Sessions usually lasted 40 minutes, with a 20-minute rest every hour, but during one 80-minute-straight session, which was followed by a 40-minute break, they noted a temperature increase from 68 to 83 degrees F. in the hall.

The 104 members of the orchestra were augmented for the recording by 25 additional musicians, most of them performing as off-stage instruments. These people, of course, could not see Leinsdorf's conducting, so a TV camera set up behind the French-horn players automatically photographed him. Closed-circuit TV sets were watched by two "tower trumpets" on folding chairs in the nearly dark left hall, and two "vassal trumpets" in the right hall upstairs.

Beyond a door at the left rear of the stage sat two flutists and two oboists. When it is almost time for them to play, conductor Woitach quietly opens the door—Symphony Hall acoustics are so good they will be heard as off-stage instruments without the use of a mike —and, himself facing Leinsdorf on the TV monitor, he conducts his four men. Their part over, he cautiously shuts the door to the stage. As he starts up a back stairway to listen from the control room one of the oboists forlornly calls, "Keep in touch."

Woitach's conducting was designed to solve one of the problems of recording —the time lag of sound. If off-stage musicians simply had followed Leins-

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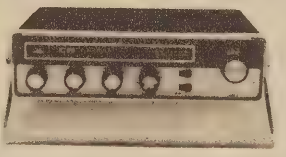

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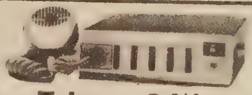

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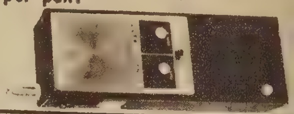

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dorf's beat, by the time their sound had travelled through the door on to the stage and then across the stage to the microphones, they would have sounded hopelessly behind. As it was, Woitach had to figure out how to conduct ahead of Leinsdorf, so that off-stage sound would arrive precisely at the correct time.

The relatively slow speed of sound also was a big problem facing the Chorus Pro Musica of Boston, which sang the choral parts of the opera. Soloists' scenes were scheduled for the 2 to 5 p.m sessions, and all scenes requiring chorus were scheduled for 7 to 10 p.m., since the Chorus Pro Musica is a semi-professional group whose members are employed as everything from typists to radiologists during the daytime.

As the chorus—which has recorded and has sung the Verdi "Requiem" with the Boston Symphony and has sung premieres of Britten's "War Requiem" in Tanglewood, Boston and New York—stands on the stage and sings, it is some 75 feet from Leinsdorf and 30 feet behind the orchestra. When its sound arrives late, Leinsdorf stops the chorus for immediate retakes.

While the chorus sings the last 10 minutes of Act I, chorus director Alfred Nash Patterson explains that the normally 120-voice group was increased—by diligently advertising and screening 460 persons—to 180. They not only had to be able to sing, practice, and study German with Irmgard Zeitler nightly since April, but they also had to be able to spend the week before the recording week at Tanglewood, where the same people making the record performed "Lohengrin" an act at a time for three nights.

The schedule set up for the week of recording was maintained, as chorus and orchestra strived mightily to perform without errors, and soloists remained in remarkably good voice all through the week.

Miss Amara also seemed to be in constant good spirits, charming some girls in the chorus during a break with an animated description of a pair of slacks, asking Mrs Konya at a playback whether her enunciation was all right, admitting that not only does she sing with her fingers crossed but she listens to her own recordings the same way, brightly explaining to Dooley why she has never sung the part of Elsa before. "I'm not that gullible; why should I sing the role of such a gullible person?"

She asks Leinsdorf after one scene has been recorded whether she can try it again from No. 55. Leinsdorf replies, "I didn't like to ask you, but I'd be delighted." Then to the orchestra, "I don't want to tire her out, she is so brave. Everybody watch it."

Dooley, currently in his third season at the Met, is singing Telramund for the first time and also participating in his first opera recording. Telramund, he says, is still too heavy a role for him at 31, and he does not intend to sing it on stage for several more years. "Recording is a new discipline and type of work for me," he says, "more difficult than the stage. It is almost humanly impossible to sing six hours a day. But I'm enjoying it very much. I'm delighted working with Mr Leinsdorf. He is a great inspiration and a powerhouse of energy."

Miss Gorr, who has recorded many times and who most likes to sing in the operas of Wagner and Verdi, also considers recording more difficult than singing opera on stage. "This is more difficult, much more. It makes me very nervous. You haven't the warmth of the public; the atmosphere is not the same. I've sung Ortrud many times on the stage, including the Met, Bayreuth and Covent Garden. It helps to have sung it before." Miss Gorr prefers the afternoon sessions, when she is more rested and her voice is clearer.

Konya has sung the title role of "Lohengrin" 202 times, including this recording, many of those performances with Miss Gorr in the cast. He would rather sing at night, when his voice has warmed up.

One of the most noted and in-demand Wagnerian tenors in the world, Konya arranged during the week for his car to be driven from the port of New York to San Francisco where he would need it during his September-through-November appearances with the San Francisco Opera, before he returned to the Met for the opera season. During the summer, the Konyas and car had been on a busy schedule in Europe, with perfomances and recordings scheduled in several countries.

"Wieland Wagner (the composer's grandson) is calling me the world's champion in 'Lohengrin,'" he says. Konya was hired by Wieland Wagner to sing "Lohengrin" in Bayreuth and gave six performances each summer during 1958, 1959 and 1960. He made his debut in the same role at the Met in 1961, but his American debut had been the year before, in San Francisco, in "The Girl of the Golden West." He recalls, "A critic wrote, 'Konya was a big success but he didn't walk like a cowboy.'

"I thing it is magnificently organised here," Konya continues. He pauses for a moment, reflects, and then comments: "In recording, a singer must concentrate more. Everything has to be perfect, and the finest little notes have to be projected."

Plans for the American recording of "Lohengrin" have been under way for two years. Maestro Leinsdorf says, "To get a good cast together for two weeks is not the easiest thing in the world. There are very few casts that can be got together in 1965 for 1966."

'Lohengrin' is uncut, including a portion that was restored in Bayreuth in 1936 and 1937 but never performed in this country. Leinsdorf says, "That has always been the principle of my recording with RCA, that portions never done in performance are included, making a complete record in two senses of the word.

"Our major intent," the conductor explains, "'is to do the work as I think it stands in all its romantic grandeur. My concept is a real romantic fairy tale and, as such, I'm hoping that the recording will come out."

EDITOR'S NOTE: Because of trade mark difficulties, the recording which is the subject of the above article is not currently on sale in Australia. Readers wishing to obtain a copy would have to make their own arrangements to import it. The article is reproduced by courtesy of "Electronic Age."

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Our prediction, in the July issue, that tape cassette equipment might easily win for itself a dual role has not taken long to find substance. Pictured herewith is a system which is currently being offered in Australia, intended to provide taped stereo music in the family car or in the living room.

The basic unit is a tape player, manufactured in the first instance by the Pioneer Electronic Corporation of Japan for Craig-Panorama Inc. of Los Angeles, California.

On the basis of visual inspection, it is a very well made unit, measuring 9½ x 3½ inches in frontal dimensions, by 10 inches deep overall. External surfaces are finished in bright chrome, with controls of black bakelite and burnished aluminium.

The controls are for Volume, Balance, Tone, Cartridge Release and Off, and Track Selector. At the rear is a well-buried two-way slide switch, allowing the equipment to be suited to positive or negative-ground vehicle systems.

The "works" of the player can be withdrawn easily for inspection or service by undoing four side-screws with a driver or a small coin. The unit slides from the case, without interfering with its ability to operate normally, and giving ready access both to the mechanical drive system and the electrical circuitry. It is fully transistorised, as expected, with most amplifier components mounted on a printed wiring board.

Glued to the bottom of the case is a circuit diagram, a little inaccessible, perhaps, but always ready to hand.

The unit, as supplied for review was fitted to take cartridges conforming to the so-called Conley or Fidelipac configuration, a four-track endless-loop system, operating at a scanning speed of 3¾ips. (See our July issue, Page 93). Two fixed stereo heads scan the tape, the required pair of stereo tracks being selected for replay by flipping a selector switch.

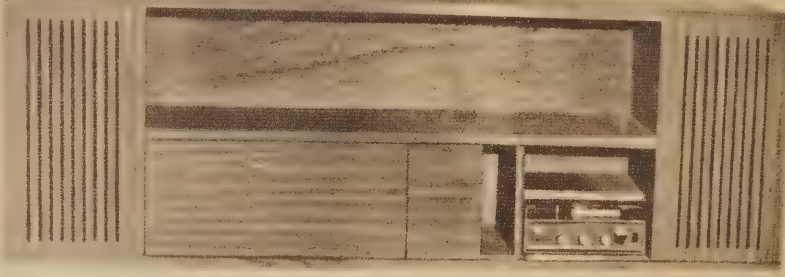
For use in a car, Craig supplies a chrome-plated cradle which normally supports the player beneath the lower edge of the facia panel, by means of knurled screws.

The accompanying loudspeakers are especially designed for fitting into a car, and normally into opposite door panels or pillars. Fitting the loudspeakers involves cutting an approximate 5-inch hole in the relevant panel and mounting the loudspeaker from the outside with self-tapping screws. The wires, which are supplied with the kit, can normally be positioned through the newly-cut hole.

When the loudspeaker is in position, a chrome-plated cover snaps over the front, completely hiding all the mounting arrangements and presenting to view only a simple perforated cover, snug against the panel.

For domestic use, the player can be withdrawn and plugged into a suitably designed cabinet unit, carrying its own loudspeakers and its own mains-type power supply.

The unit pictured herewith is manufactured in Australia for the purpose and is intended for wall or shelf mounting. Well finished in dull teak imitation panelling, it measures 60 x 20 inches in frontal dimensions and is 12 inches deep. At each end is a loudspeaker in its separate enclosure, with the centre space available for storing tapes, books, etc., as well as housing the actual tape player.



The shelf unit, intended for mounting in the living-room, is an imposing piece of cabinet work in a laminated imitation flat-teak finish. Sliding doors hide the player unit and any stored tape cassettes.

With negligible drain, the mains power can be left on for lengthy periods, if desired, the necessary connections being made automatically as the player is pushed into position.

Operation of the unit is simplicity itself:

The player circuits are activated only when a tape is in position, so that operation involves merely selecting the desired tape cassette and pushing it into the playing slot. The desired track can be selected and the tape thereafter continues to play endlessly until the lever is actuated which disengages the capstan, switches off the electrical circuitry and releases the cartridge.

How does it sound?

One can hardly base final judgment on a couple of cassettes as supplied but the sound was, in fact, clean and pleasant, with the excellent separation of which tape is capable.

Very little tape hiss was evident and, in this regard, it would appear that the designers have deliberately aimed the high frequency response to retain a reasonable order of brightness without running into the fully fledged high-fidelity zone, which would have shown up the inherent hiss of most current pre-recorded tapes.

In this respect, the unit reflects what is currently the "state of the art" in respect to 4-track pre-recorded stereo tape reproduction: Pleasant, smooth, clean and with good separation, but saddled with an awkward compromise involving extreme treble response and hiss level.

However, these remarks are directed to the ultra hi-fi fan, who is given to worrying about such things. In terms of clean, pleasant music, the performance of the system was never in doubt!

The Craig player, with or without car-type fittings, and the Australian-made domestic cabinet unit are being handled in this country by Messrs Dynacoustic Electronic Pty. Ltd., of 668 Prince's Highway, Tempe, N.S.W.

Prices are quoted as $175 for the car unit, plus $20 to $30 for installation, where applicable. The home unit, complete and ready to plug in retails for $372.

The company is able to offer cassettes in three sizes, which may be plugged into the unit at will, with playing times of ½, 1 and 2 hours. Two overseas catalogues which accompanied the review equipment listed a very large range of titles, mainly at "middle of the road" level and drawn from labels and groups well known here, in many cases, for their appearance on disc (W.N.W.) ■

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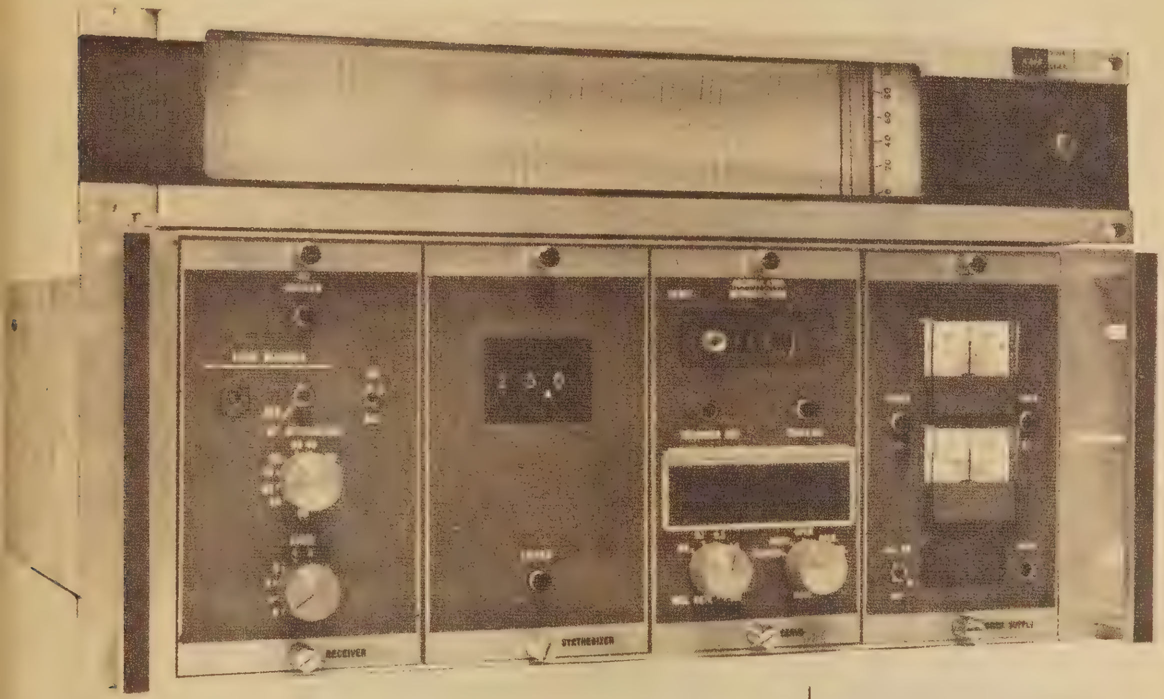

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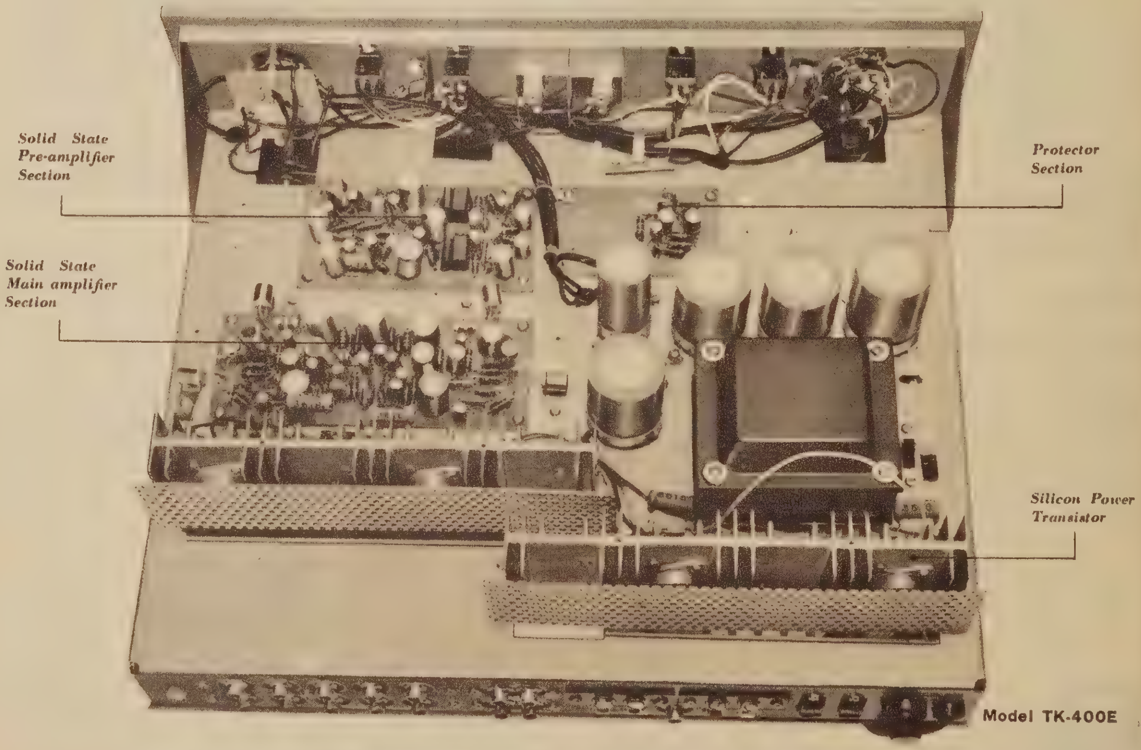
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By JOHN BORWICK, B.Sc.

PART FIVE — PICKUP CARTRIDGE MECHANICS

In Part Four (October issue) we compared the ways in which crystal, magnetic and variable resistance (Miniconic) pickup cartridges convert the mechanical energy of stylus movement into an electrical signal. We also looked at the more important electrical aspects of pickups such as impedance, sensitivity and the need for frequency correction.

Now we can turn to mechanical matters and the first of these is mechanical impedance; in other words the working load presented by the pickup as seen by the groove.

Just like electrical impedance, this may contain purely resistive (frictional) components or it may have frequency dependent components analogous to inductance (mass) and capacitance (compliance—which is the inverse of stiffness).

Pickup designers must wrestle with these impedance elements so that the known forces due to the recorded velocities, amplitudes and accelerations on standard record grooves will produce acceptable stylus movement.

If they do their sums right, the recorded music stands a chance of being reproduced faithfully, the pickup will stay in the groove and the groove walls will not suffer permanent (plastic) deformation.

But even this qualified degree of success is conditional on the record companies continuing to cut records to the agreed standards and the user employing a suitable arm which is properly mounted and at the correct playing weight.

These inductive and capacitative elements will affect the frequency response and of course give rise to resonances (peaks or troughs in the response).

Compliance: Compliance is defined as the amount of displacement of a spring, etc., caused by a unit force. It is generally expressed as so many millionths of a centimetre per dyne (i.e. 10^{-6} cm/dyne). A number of compliances have to be considered in a typical cartridge with a cantilever mounting, back suspensions, etc.

Oddly enough, a basic compliance in record reproduction is that of the disc material itself. The plastics used, provided the elastic limit is not exceeded—which would result in permanent deformation of the groove—tend to "give" under the pressure of the stylus and spring back when the pressure is released.

The tuning of the disc compliance (e.g. 2.5×10^{-6} cm/dyne for Vinyl) with the effective stylus mass produces a high frequency resonance at around 8-20 KHz and this should be designed to be above the audible frequency range if possible. Since the record compliance is "given," this can be done only by reducing stylus mass. (The use of different disc materials is one of the reasons why different results are sometimes obtained on measuring pickup response with different test discs.)

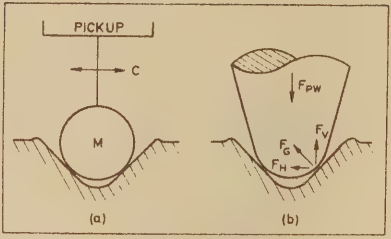

Figure 1: (a) The groove "sees" the stylus as a sphere of mass M on a spring of compliance C. (b) The playing weight FPW must always exceed the vertical component of the groove force. This force in turn will depend on the compliance and the nature of the recorded waveform.

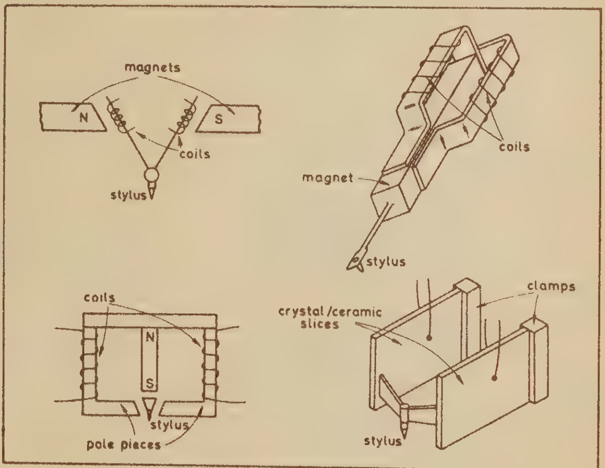

Figure 2: Four common types of stereo pickup in which separate signals can be generated by movements in planes at right angles to each other. The types are moving coil and moving magnet (top), moving iron and crystal ceramic (bottom).

Another important compliance is that of the stylus mounting which resonates with the overall arm/pickup mass to produce the main low frequency resonance of a pickup. This is normally placed between 12 and 20Hz—avoiding 22.5Hz which is a basic rumble frequency on many turntables.

The forces involved: The mechanical impedance of pickups is clearly a complex subject but, fortunately for our purposes, it is enough to get a general picture of the more important factors.

Taking mono records for simplicity, the groove in figure 1a sees the stylus as a sphere S which has to be accelerated from side to side. Since it is relative motion of the stylus and the main mass of the pickup which generates the electrical signal, we can regard the main body of the pickup as immovable. Effectively, then, the groove has to act on a sphere of mass M connected to a spring of compliance C.

The forces involved can be resolved as shown in figure 1b. The groove wall is inclined at approximately 45° to the vertical and so the force FG it exerts on the stylus is equivalent to FV (vertical) plus FH (horizontal). The vertical component FV is opposed by the playing weight FPW and it is clear that FPW must be at least as great as FV. Otherwise the stylus will tend to slide up the side of the groove and produce serious distortion.

The horizontal component FH we can look upon as the one doing the work of making the stylus trace the recorded waveform. Obviously the force has to be greater for larger recorded amplitudes and for low values of the compliance C.

PRACTICAL LIMITS: If high values of playing weight FPW could be tolerated, then all our other forces could be proportionately large. In practice, however, the researches of F. V. Hunt have shown that the small tip radii of today's styli impose a limit to the playing weight which can be applied before the stylus inflicts permanent damage to the groove.

It appears that a 0.0005in. (half thou.) stylus, for example, should ideally have a playing weight of no more than about 1 gram if attrition of the disc material is to be avoided.

High compliance is therefore desirable in modern pickups and increasingly necessary at lower playing weights. A figure of 5×10^{-6} cm/dyne is taken as adequate, rising to 20×10^{-6} if the playing weight is reduced to, say, 1 gram.

The need to keep our forces low means that the effective stylus mass must also be kept to a minimum. Indeed, J. Walton, formerly of Decca, is a strong advocate that stylus mass is the most important consideration in pickup design. As yet, many manufacturers do not quote this property in their specifica-

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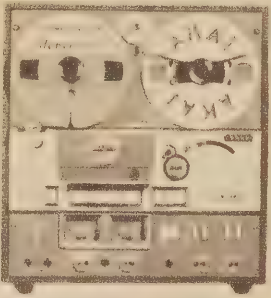

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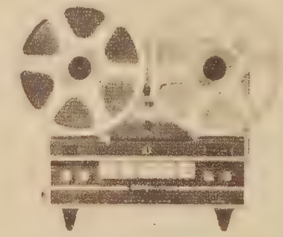

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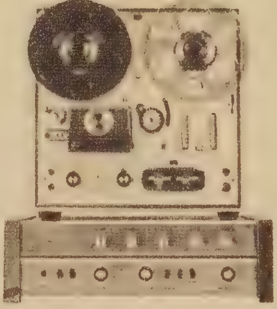

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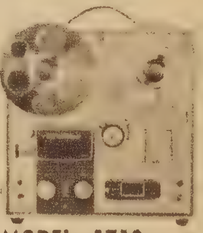

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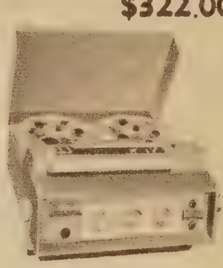

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ns but values of a few milligrams : the norm. Mr Walton suggests that maximum of 1.5 milligrams should the rule.

STEREO PICKUPS: Monophonic ckups designed to reproduce the lateral veforms that we have been consider- ; so far did not require special pro- rties in the vertical direction. With the vent of stereo records, however, the uation was drastically changed. Mono ckups tended to have very low ver- al compliance, for example.

There was no vertical recorded signal be reproduced and so vertical re- onse by the pickup was minimised as means of cutting down spurious mps, "pinch effect" distortion and the rtical component of motor rumble.

As the diagrams in Part One illus- ted, however, the 45°/45° system of ording two-channel stereo in a single oove requires that pickups shall re- ond to vertical as well as horizontal rces. This is obvious in the photo- crograph in figure 3. Vertical com- ance is therefore very important. wever, due to the lower levels of dulation present in the vertical com- nent of stereo signals, a somewhat ver value of vertical compliance can tolerated compared with the horizon- figure. Indeed, too high a vertical npliance is undesirable since the sty- is not driven during the down half les but must fall under gravity, aided the stiffness of the suspension.

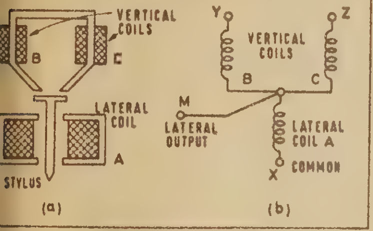

Figure 4: Showing the arrange- ment of coils and the connec- tions in a sum-and-difference pickup.

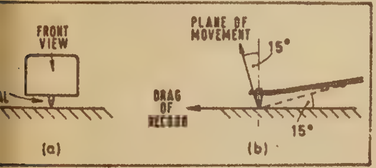

Figure 5: (a) From the front, the stylus appears vertical. (b) To natch the rake angle of cutter styli, the pickup stylus is nowa- lays pivoted so as to move in a plane 15 deg. forward of vertical.

o underline the dual construction by ans of which stereo pickups can gene- a pair of output signals correspond- to the right and left recorded chan- s, and to complement the mono pick- diagrams in Part Four, I have sketch- some typical types in figure 2. In all es, stylus motion at +45° or 5° to the vertical will activate the gnetic or crystalline generator ociated with the right or left channel pectively.

t is well known that stereo cartridges compatible, that is they will repro- e mono records perfectly well. (We can shelve meantime any discussion on the possibility that the fine 0.0005in stereo stylus may ride too low in the groove on some older records, particularly if these have been played previously with a conventional 0.001in mono stylus.) The lateral movement imposed by a mono disc will generate equal signals in the two stereo networks: it is the same situation as obtains when a central sound source is being recorded in stereo.

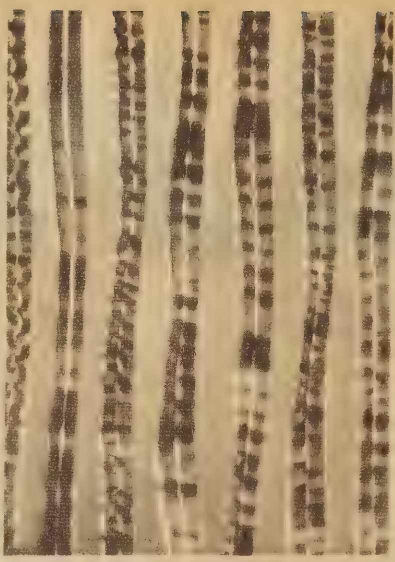

Figure 3: The combined 45/45 deg. signals on a stereo disc produce complex variations in depth as well as in lateral line of groove. (Photograph by Cecil E. Watts.)

By connecting the two outputs to the amplifier in parallel, a sum signal results. Indeed, as a bonus, the correctly phased connection has the effect of causing any spurious vertical signals, e.g., tracing distortion, to cancel out.

CROSSTALK: Since the generators are mutually at right angles, they should theoretically be mutually exclusive. I mean that a tone recorded in the right channel only (that is, in standard practice, the right hand or outer wall of the groove when looking at the front of the pickup) should produce a zero signal in the lefthand generator and vice versa.

Any breakdown of this channel separation is referred to as crosstalk and is quoted in dB of signal in the unwanted channel relative to the wanted channel. A crosstalk figure of —20 dB at 1,000 Hz is considered adequate, though little audible degradation of the stereo effect will occur if the crosstalk is higher outside the band, say, 300 to 8,000Hz.

SUM - AND - DIFFERENCE PICKUPS: Readers will often have heard of "sum-and-difference" stereo pickups of which the Decca ffss is a famous example.

Here, with incidentally the facility of closely equalising the channel outputs and so achieving improved crosstalk performance during assembly, the twin magnetic generators (of the variable reluctance type) are still mutually at right angles but are not in the normal 45 deg./45 deg. configuration. Instead, they respond respectively to horizontal and vertical stylus movement (our old friends lateral and "hill and dale"—see figure 2 in Part One).

Figure 4a shows the general construction. The lateral coil A is energised by side-to-side motion of the stylus and the twin vertical coils B and C have currents induced in them by up-and-down stylus motion.

When the coils are connected as shown in figure 4b, B and C are arranged to produce equivalent voltages to the lateral coil A (for equal stylus velocities in their own sense) but to be in opposite sign to each other. The output appearing across XY for a +45° stylus motion (signal in right channel only, let's say) would then be A + B = 2 units (the sum) and the output across XZ would be A—C=0 (the difference). The converse would apply for a —45° stylus motion, and so in practical terms the signals appearing at terminals XY and XZ are exactly equivalent to those of a 45/45 pickup cartridge.

Incidentally, by taking the output across XM, a purely lateral signal can be derived for reproducing mono records.

RAKE ANGLE: It goes without saying that a pickup stylus should normally appear vertical when viewed from the front (see figure 5a), and it might be expected that its movement should be vertical also when viewed from the side. In fact, the tendency nowadays for stereo pickups is to arrange the pivot point so as to give the stylus a forward "rake" of about 15° (see figure 5b).

The reason for this is that during the recording process the cutter stylus is effectively at the end of a cantilever arm which is pivoted at a point above the record surface. Therefore, the plane of movement of the cutter arm is not truly horizontal but at an angle. The precise angle is arguable, though 23° used to be quoted for the Western Electric cutter, and the compromise angle of 15° forward of vertical is now recommended for pickups (achieved for example by canting of the cartridge in its mounting and/or the stylus in its cantilever.

But we are now trespassing on the subjects of styli and pickup arms, which are due to be discussed in our next instalment.

(To be continued).

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Classical reviews

By JULIAN RUSSELL

Nilsson in Turandot . . . "unremittingly forceful"

UCCINI—Turandot. Complete Opera. Birgit Nilsson (Turandot); Angelo Mercuriali (Emperor); Bonaldo Giaiotti (Timur); Franco Corelli (Calaf); Renata Scotto (Liu); Guido Mazzini (Ping); Franco Ricciardi (Pang); Piero de Palma (Pong). Chorus and Orchestra of Rome Opera House conducted by Francesco Molinari-Pradelli. HMV Stereo SANS159/61. (Five sides.)

The role of Turandot might be comared to that of Verdi's Otello despite heir differences in character and sex. Vhere, however, they resemble each ther is in their unceasing demands for heir interpreter to come perilously close o yelling for the greater part of the erformance. It is therefore difficult to nd, from the general run of Italian pera singers, artists prepared to underake either of these roles. They are sually filled either by performers who, ecause of age, have little to lose in uality because of constant strain, or hose naturally gifted with extra-heroic oices.

In the latter class is Birgit Nilsson, etter known in Wagnerian roles than n Italian. A soprano who can sing Brunnhilde need fear nothing from Turandot, and Nilsson tackles the part vith plenty of brio and commendable ccuracy of pitch. She displays, however, little of bel canto charm, which s unnecessary in the earlier parts of er performance but is useful later vhere the score was completed by lfano, after Puccini's death. The rest f the time she must project the inflexble iciness and cruelty of her far-fromavoury character.

Hers is a broad performance, unconerned with details of characterisation, ut unremittingly forceful. One can beieve in her, though it is difficult to nderstand the love she is supposed to nspire in young men prepared to die n an attempt to win her. She might vell be compared to a female spider vho eats her mate immediately he has ertilised her. But in Puccini's opera hey are denied even this satisfaction efore execution. Having said all this, must add that I suppose Nilsson is as ood a Turandot as you'd find nowaays, despite her lack of persuasion.

Opposite her Franco Corelli is in plendid form as Calaf though I hope hat his tendency to a pain-laden deivery in the manner of Gigli doesn't evelop any further. He has a shining enor, hits his notes dead in the middle, ut could, with profit to Puccini's sensiively scored orchestral part, have been ecorded a little further away from the mike. For instance, at the opening of the third act, the atmospherically recorded distant voices of the crowd, to be made comfortably audible, bring Corelli much too close when he enters.

Poor little Liu is sympathetically projected by Renata Scotto. She will win everyone's pity and give them much pleasure as a welcome contrast to the much more forceful Nilsson. Giaiotti is a highly competent Timur, and those three odd characters, Ping, Pang and Pong, are for once presented as real human beings and not caricatures.

Molinari-Pradelli conducts the whole score with careful attention to its elegant chinoiseries and handles the three councillors' big scene with much more than usual sensitivity. The chorus is admirable and the sound good, if one excepts a little over-loud singing, a feature that, alas, in this opera, often intrudes in opera houses.

* * *

GOEHR (ALEXANDER) — Two Choruses, Op. 14. John Alldis Choir conducted by John Alldis.

DAVIES (PETER MAXWELL) — Leopardi Fragments for Soprano, Contralto and Chamber Orchestra. Mary Thomas (soprano); Rosemary Phillips (contralto); Members of the Melos Ensemble conducted by John Carewe.

WILLIAMSON (MALCOLM) — Symphony for Voices, John Alldis Choir conducted by John Alldis.

BENNETT (RICHARD RODNEY) — Calendar for Chamber Ensemble. Melos Ensemble conducted by John Carewe.
Record Society Stereo recorded under the auspices of the Gulbenkian Foundation, Music Today Series Vol. 4. S/6190.

These four are the leaders of the younger school of avant garde British composers. At any rate, they are the most frequently performed. At 35, Malcolm Williamson, an Australian, is the oldest.

Goehr comes next at 34. He was born in Berlin, the son of the well-known conductor Walter Goehr, but was taken to London as an infant, and continues to live there.

Davies, born in Manchester, is 32, and Bennett, born at Broadstairs (Kent) is 31. Davies, by the way, is at present "composer in residence" at the University of Adelaide.

My personal preference is for Williamson's music which has a decidely more lyrical quality than that of the other three. He is also the most conservative, though the term must be accepted relatively here. Anyone unused to avant garde music will not, of course, find him conservative at all, but on the contrary, very difficult. His melodies range over a very wide compass and are freely shaped from often remote intervals. There is nothing "spiky" about his melodic line, and it is perhaps for this reason, coupled with his industry, that a charge of "facility" is often laid against him.

In this work, the opening song for contralto solo and the third one are thought by some critics to be discrepant in the context of the other three. I cannot see why. His work here is perhaps only a minor one, though pleasing. The choir level is a little low and calls for volume control adjustment.

I think the charge of facility could be more justly sustained against Bennett's music. He had some success last year in England and on the Continent with an opera, "The Mines of Sulphur," which the Sadler's Wells Opera Company were playing in Vienna when I was there.

His music has the effect of suggesting that it wrote itself, so easily is it conceived and worked over. Everything is set down with impressive technical skill, but, irritatingly, one senses that it could be made more interesting — I nearly wrote better — if only he could conquer a fear of being thought too tuneful.

Goehr uses a style which might be described as anglicised Webern. His work has some beautiful bars, beautifully sung here despite their extreme difficulty, but you will find little to remind you of the text in the music. He is no disciple of the Wagnerian method of "fertilising poetry with sound." Despite the use of highly emotive texts his work is tempered by a truly English spirit of compromise, and he writes as naturally for the voice as Richard Strauss.

Davies, too, can write expressively for the voice when he wants to, but often calls on the singer to do ugly things. However, he can express bitter introspection and desolation better than most. His music is perhaps the most "difficult" of the four.

As was the case with the previous three Gulbenkian Foundation discs, the standard of performance is again high and the quality of the whole production first rate despite the club price at which all four are offered. I must warn, however that you must start off with a genuine sympathy for this kind of music if you are to get anything resembling pleasure out of this last example.

* * *

TIPPETT—Concerto for Piano and Orchestra. Piano Sonata No. 2. John Ogdon (piano). Philharmonia Orchestra conducted by Colin Davis. Record Society Stereo S/6198.

Tippett is an active British member of the generation before those four mentioned above. At times, in the concerto, he displays a strong lyrical impulse which he seems compelled to obscure by surrounding his melodies with thick strands of irrelevancies. The concerto is characterised by unusually dense orchestral writing, though the solo piano part, beautifully played by John Ogdon, is deliciously limpid. That the problem of recording such sound entirely successfully was not altogether satisfactorily solved is not surprising. The piano

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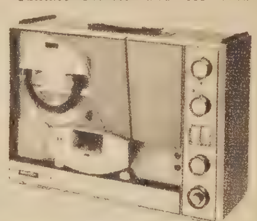

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part, however, at its most delicate, as well as at its most forceful, is a continuing delight to the ear.

I found the Piano Sonata much more approachable and enjoyable. Tippett's form is unusual. He ignores first movement sonata form development and substitutes instead short phrases oft-repeated, sometimes in full, occasionally in part. Sometimes he is content just to repeat a chord rhythmically. And in this work Tippett makes eloquent use of silence. In terms of language his style might well be called agglutinate and offers little difficulty to appreciation once you have got the general idea.

In this, too, Ogdon's playing is beyond praise. He sets out everything with delicious clarity, faces technical perils with unruffled equanimity and controls contrasting sonorities and dynamics with dazzling brilliance.

* * *

ROSSINI—La Cenerentola (Cinderella). Alda Noni (Clorinda); Fernanda Cadoni (Tishe); Marina de Gabarain (Angelina); Hervey Alan (Alidoro); Ian Wallace (Don Magnifico); Juan Oncina (Don Ramiro); Sesto Bruscantini (Dandini). Glyndebourne Festival Orchestra and Chorus conducted by Vittorio Gui. HMV (Everyman Opera Series) Mono HQM1011/3.

This is the 1954 set now re-issued at a reduced price on HMV's Everyman Opera label. It is very well worth the modest investment necessary to acquire it for both performance and recording have worn very well indeed. Cenerentola is a sparkling opera, full of lovely solos and brilliant ensembles, many of which feature the famous Rossini crescendos.

It is very difficult to sing, for everyone must employ the cleanest possible of techniques. Moreover the conductor, as he is here, must be unceasingly vigilant to keep his ensembles tidy and at the same time expressive. Except for the more modern engineering to be found in more recent sets—and I hasten to repeat that the sound is still good on the old one—I cannot recall any I would recommend in preference to the Everyman. In fact I would make only one change in the old cast from the Fabritis version recorded some 10 years later. In this Simionata makes a much more charming Angelina than Marina de Gabarain. Highly recommended as a bargain.

* * *

MOZART — Symphony in C Major (K.200). Symphony in B Flat Major (K.319) Cleveland Orchestra conducted by George Szell. CBS Stereo SBR235160.

The Cleveland under Szell have long been worthy of their notable reputation for precision. And that virtue is again generously demonstrated in these two symphonies. But there is one feature that all Mozart lovers might not approve—tempos.

Choice of tempo, is, of course, as purely subjective a privilege for the conductor as it is for his audience. There are, however, conventional considerations that complicate this problem. And while we can ignore others, there is one that might be regarded as a golden rule in the interpretation of Mozart's music. He is known to have disliked ultra-fast tempos as much as he did the tone of the flute. And in the outside movement of both these symphonies Szell sends his orchestra along at a bat that it is difficult to imagine the composer approving.

True, there is no loss of accuracy and the phrasing remains exquisitely shapely. But that they sound rushed and too hard-driven even Szell's greatest admirers would, I think, have to admit. But elsewhere I found both symphonies immensely enjoyable. In the C Major, for instance, where the andante marking can be stretched, and often is, to an adagio, with the effect of making the elaborate ornamentation sound sluggish, Szell establishes an admirable pace. If the rhythm in the minuet is always very steady it never becomes wooden, and its rigidity is successfully disguised by dynamic subtleties.

In the slow movement of the other symphony, the B flat, Szell makes one ppreciate all the richness of Mozart's nspired scoring and makes its wee canon a marvel of neatness.

As a fill you have the "Figaro" Overure in a brilliant performance playing hree seconds under four minutes. But his is a piece that doesn't suffer under uch treatment.

★ ★ ★

CHONBERG — Pierrot Lunaire. Alice Howland (sprechstimme); Abram Loft (violin and viola); George Sopkin (cello); Gilbert Kalish (piano); Louise Burge (flute and piccolo); Chester Milosovich (clarinet and bass clarinet). Conducted by Herbert Zipper. Record Society Mono (Music of the 20th Century Series). 6165.

For the first time this, one of the nost important works to come out of the econd Viennese School, is now available in Australia otherwise than under pecial indent. Pierrot Lunaire is a work o one interested in contemporary music an afford not to know. It was the first omposition to make the general music ublic aware of the changes that were eing made to the whole structure of usical thought and invention by Schonerg in the first decade of this century.

The composer had not yet adopted erialism and there is still much of the 9th-century German romantic school to e met all through. What was novel was chonberg's completely free use of harony — or dissonance — and the introuction of sprechstimme instead of a ung vocal part. Sprechstimme exaggertes the modulations on natural speech a point where, though few actual otes are indicated, the voice glides up nd down in magnified speech intervals.

In this feature the present recording a considerable improvement on the d Argo version under Leibowitz, ised some 10 years ago. In this Ethel emser produced mewing sounds that ere not only distressing to the ear but ften downright comic. Alice Howland's eatment is much more effective and usical.

Another improvement is in the recordg of the instrumental parts, which erge much more clearly in the new sc. Schonberg never used more than e instruments simultaneously, so that ery note played is of the greatest imrtance. None is missed here, so adirable is the balance throughout.

In my review of this new version in he Sun" I regretted the absence of any text accompanying the disc which might have helped newcomers to Schonberg to understand just what he was striving to do. Since that notice appeared I have been informed by the head office of the World Record Club in Melbourne that such material is indeed supplied with each disc and copies were sent to me. These consist of English-German copies of the 21 poems set by Schonberg to a German translation of the French original by Albert Giraud.

I feel I owe it to readers unfamiliar with even the comparitively early Schonberg represented here to say that they will not find him easy at first. However it should not be long before some real beauties emerge, and though many might never find themselves in complete accord with Schonberg's theories and practice, the influence he has had on composers of the present-day cannot be exaggerated — or ignored.

★ ★ ★

STRAVINSKY—Petrouchka. Complete ballet (revised 1947 version). Columbia Symphony Orchestra conducted by Igor Stravinsky. CBS Stereo SBR235138.

For his latest recording of this early but magisterial work Stravinsky has used the version he rewrote in 1947 for a smaller orchestra than that used in the original production. It may be recalled that still earlier he also abridged the scoring of "The Firebird." The changes all result in simplification of the original, and, I suppose, added refinement. But in my opinion one movement suffers — the first "Fair Scene," where the more slender orchestral means destroy, to some extent, the splendid sense of bustle that was in the original.

As to the rest, I find it all eminently satisfying, full of wonderfully bouncy rhythms and playing of exquisite accuracy and apparently inexhaustible vitality under its 84-year-old composer-conductor. The engineering is first rate, and those interested will find some interesting facts and comments in the sleeve notes Stravinsky himself wrote for this occasion. It is obvious that he now thinks this the definitive reading of one of the finest ballets ever written.

★ ★ ★

RITUAL FIRE DANCE. The Philadelphia Orchestra conducted by Eugene Ormandy. CBS Stereo SBR-235164.

Here is a disc of popular items which High Fidelity enthusiasts might well acquire to demonstrate the virtues of their equipment. The Philadelphia plays with its customary gorgeous tonal richness. The first desk soloists add their contributions in true prima donna fashion. The engineering is quite wonderfully faithful.

Much ballet music is included—"Boutique Fantasque" (Rossini), Ponchielli's "Dance of the Hours" and De Falla's "Ritual Fire Dance"— all of which I felt would have benefited slightly by a conductor who had spent some time conducting ballet regularly. They are ever so slightly rigid rhythmically. But the other pieces should have a wide appeal to those who don't want to take their music too seriously.

Here is the full list of titles: Tarantella, Cossack Dance and Can-Can from "Boutique Fantasque" (Rossini-Respighi); Dance of the Hours (Ponchielli); Hungarian Dance (Brahms); Ritual Fire Dance (De Falla); Dance of the Comedians (Smetana); Dance for Six from "William Tell" (Rossini); Polka from "Schwanda" (Weinberger); Polonaise from "Eugene Onegin" (Tschaikowsky).

★ ★ ★

BERLIOZ — Symphonie Fantastique. French National Radio Orchestra conducted by Sir Thomas Beecham. World Record Club Mono T/4092.

Another reissue from H.M.V., this time put out by the World Record Club, is this fine performance by Beecham of a work he understood as few others have done in living memory. Beecham, all his life, fought to establish Berlioz at a time when his reputation was at its lowest in England, and his performances never failed to thrill me whether they were of slight pieces like the "Beatrice and Benedict" overture or more massive works such as that under notice.

It may interest readers to know that since this Beecham recording was first made in 1959, no fewer than 11 other alternative versions have been issued here in Australia alone. I like none of them as much as Beecham's; though, as in the case of the opera (Cenerentola) mentioned above, there have been improvements in recording techniques since it was first put out. But once again the sound wears very well, the spirit of the music is as vividly evoked as ever, its phrasing peerlessly elegant and its rhythms exhilarating.

★ ★ ★

ELGAR—Concerto for Violin and Orchestra. Yehudi Menuhin and the New Philharmonic Orchestra conducted by Sir Adrian Boult. H.M.V. Stereo OASD2259.

Menuhin had already won a great reputation as an infant prodigy some time before he first recorded this concerto back in 1932. He was then 16 and his performance made everyone marvel, including the composer who conducted the orchestra for the occasion. This time Boult is the conductor — as fine an Elgarian as any living today — and

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Menuhin, far from setting out to reproduce his original performance with the benefits of modern engineering, restudied the work afresh.

Let me say at the outset that this has in no way impaired the spontaneity that characterised the original, and Menuhin has managed to carry over into middle-age — he is now 50 — the lyricism that made his first recording so notable. He now has the advantage, too, of bringing to bear on difficult passages firmer discipline than was possible 34 years ago.

As to the work itself, it remains to me as finely wrought as ever, its nobility never degenerating into pompousness, its passion unfaded. Boult and his orchestra provide an exemplary collaboration and the 1966 engineer has been careful to give every feature just the right weight. This means that not only does the solo part sound as naturally placed as it would in a concert hall, but that Elgar's inimitable brass, when it blazes to a climax, does so without threatening to overwhelm the rest of the orchestra.

The 1932 recording is still available, by the way, transferred to a low-priced LP label.

* * *

MOZART—17 Festival Sonatas for Organ and Orchestra. E. Power Biggs (organ) and the Columbia Symphony Orchestra conducted by Zoltan Rozsnyal. CBS Stereo SBR-235159.

These joyous little pieces gave me much pleasure. All are brief, and all are in the major. The orchestral parts are, in the main, scored for strings only with violas omitted. In some the organ is asked to do no more than fill in the harmonies from a figured bass. Others have more interesting organ parts written out in full. Their function was to supply music for the pause between the Epistle and the Gospel during the Mass, and for that reason some scholars prefer to call them Epistle Sonatas.

Only in the last three does Mozart add trumpets, horns, oboes and drums to heighten the ceremonial effect magnificently. Their brevity can be estimated by the fact that all 17 fit comfortably on to a 12in disc. There may be some who think that Biggs sometimes overestimates the importance of his instrument — a light-toned sweet organ — when it should fill only a minor function. But I have no such complaint. I found them all charming.

* * *

SCARLATTI—TOMMASINI. — The Goodhumoured Ladies Ballet Suite. Bach-Walton — The Wise Virgins Ballet Suite. Concert Arts Orchestra conducted by Robert Irving. World Record Club Stereo T/4082.

Here are two other ballets which, like "Petrouchka," noticed above, were commissioned by the great Diaghileff—only later, in the early 1920s. I think you should enjoy both. There is elegant 18th century crispness in "The Goodhumoured Ladies" and expressive warmth in "The Wise Virgins." These are reissues and far-from-recent examples of the recording engineer's art—or should it be called science? At any rate, though always clear, the sound is a little plummy by modern standards. Both works abound in beautiful melodies—well worth the modest outlay. ■

DOCUMENTARY RECORDS

Reviewed by Glen Menzies

CHRISTOPHER MARLOWE: "Dr Faustus," Richard Burton and members of the Oxford University Dramatic Society. H.M.V. Mono OALP 2270.

In February of this year, the Oxford University Drama Society presented Christopher Marlowe's "Dr Faustus," and invited Richard Burton as guest artist. Their choice of Burton in the exacting role of Faust is completely vindicated by his performance on this recording, which is an abridged version of Neville Coghill's original Oxford stage production. In preparing the text for the recording, Mr Coghill has retained the central core of the play which is essentially a tragical poem, containing many of Marlowe's most magical lines.

In the full text of the play there are many additional scenes of comedy, farce and pantomime in the manner of the theatre of the day. Marlowe was born in the same year as Shakespeare and had he not died young, murdered in a tavern brawl, he might have rivalled the great playwright.

In this performance our attention is held from the outset when the scene is set by the Chorus of Robert Scott describing the brilliant Dr Faustus, from his humble beginnings to his present greatness as a Doctor of Divinity at Wittenburg University, in Germany. Faust is introduced to us in his study meditating on his desire for greater knowledge and power. Thinking to use the Devil to gain his ends, he summons Mephistopheles by magical incantations. In the dialogue which follows, Faust sells his soul to the Devil in exchange for this knowledge. Like so many men of the age, he had a great thirst to know more about the world beyond the oceans and the Universe. After all, the play reflects the time in which it was written, the Renaissance, when so many long-cherished beliefs were being seriously questioned.

After the philosophical discourse on Side 1 the great theatrical moments occur on the second side beginning with a parade of the Seven Deadly Sins, clearly depicted by actors with distincive voices. Then follows the remarkable scene at a party where three intoxicated fellow scholars ask Faust to use his powers to bring before them Helen of Troy, and their wonderment at the vision is conveyed in sound with great dramatic intensity. Then, in what is perhaps the highlight of the play, Faust addresses himself to Helen, the most beautiful woman of history, beginning with the famous line: "Is this the face hat launched a thousand ships?"

This memorable line, and the lines hat follow, as spoken by Richard Burton on this recording, are worth the price of the disc alone. It is as if the actor were speaking them at the very moment of Marlowe's inspired creation. He allows himself all the time in the world for he sensuous words and phrases to make heir full impact, and his sense of pausation is superb; the long-held silences between words are as eloquent as the words themselves.

Faust's final damnation at the midnight hour is appropriately horrifying, but immediately a sense of calm descends with the Chorus of Robert Scott speaking the moving epilogue which begins:

"Cut is the branch that might have grown full straight
And burn'ed is Apollo's Laurel which sometime grew with this learned man."

The large supporting cast of undergraduates is more than adequate in the face of Richard Burton's powerful portrayal of the tragic figure of Faust. This is particularly so in the case of Andres Teuber's Mephistopheles, played with the right touch of evil but with an almost ingratiating charm. Robert Scott as the Chorus is memorable in a different way and it is interesting to note that he understudied Burton's own role.

Altogether this is a quite remarkable recorded performance, directed with impeccable taste by Denis Comper, who allows all the voices to emerge with the utmost clarity and without any sense of haste, developing the atmosphere of the tragedy as it progresses toward its inexorable end.

* * *

YVGENI YEVTUSHENKO in person. A live recording of the complete recital in Sydney, 28th March, 1966. Mono ATA 32067.

The visit to Australia of the 32-year-old Russian poet Yvgeni Yevtushenko at the time of the Adelaide Festival earlier this year, turned out to be a sensational success. He played to packed houses, including over 2,500 people in the Sydney "Trocadero" where this recording was made. Yevtushenko is one of the greatest of the post-war Russian poets, representing as he does a quite new generation seeing old truths through fresh eyes as each new generation must. His integrity is such that he has become this new generation's unchallenged literary spokesman and has shown the way to many other young Russian poets.

In releasing this record the A.T.A. label people must have the success of the poet's recent visit in mind, because to issue a record containing nine fairly long poems spoken in the original Russian denotes some optimism on their part. Locally produced poetry and spoken word records are not plentiful in this country, so this move is both commendable and enterprising. However, it's a pity that a leaflet containing English translations of the poems has not been included in this album. I have perused no less than four volumes of the poet's works but from none of these was I able to gather enough translations to cover the nine poems on the disc. I mention this because translations would go a long way towards a proper appreciation of this poet's highly individual style of reading.

From what I saw of his performance in the A.B.C. television program taken at the Adelaide Festival, Yevtushenko has a singularly magnetic personality. One can't help but get caught up in the great tidal swell of his declamatory and impassioned delivery—one moment a whisper and next a roaring torrent of words—but isolated from the visual presence of the poet (who is also a brilliant actor) this style can become slightly monotonous.

In the Adelaide television program this problem did not exist, as Peter O'Shaughnessy read English versions before Yevtushenko himself spoke. It seems a pity, in view of O'Shaughnessy's own "star" quality, that the opportunity was not taken to make use of the same format in this album, even if it meant using fewer poems and dispensing entirely with the farewell speech. The poems themselves range all the way from the impassioned protest and humanism of "Baba Yar" which tells of the Jewish massacre at Kiev, to "Hail in Kharkov" a delightful nature poem which has an almost musical impetus, and the witty observations of "Girl Beatnick."

I'm not at all sure that the Sydney "Trocadero" was the ideal place from an acoustical point of view, in which to make this recording. A more directional microphone might have been used, as one is constantly aware even in the quietest passages of the nearby public address speakers which add a disconcerting echo effect. The gains made in spontaneity by recording a live performance may be lost when the result is listened to in the quiet intimacy of our own sitting room.

However, for the many thousands who were present at these poetry recitals this record, whatever its drawbacks, may help to recapture for them some of the magic of the poet's personality. ■

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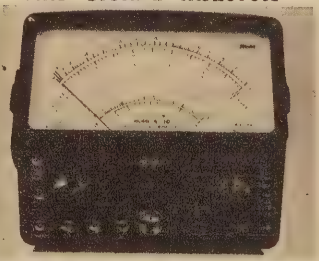

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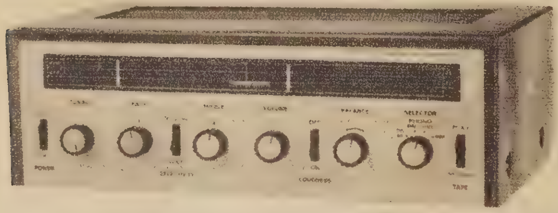

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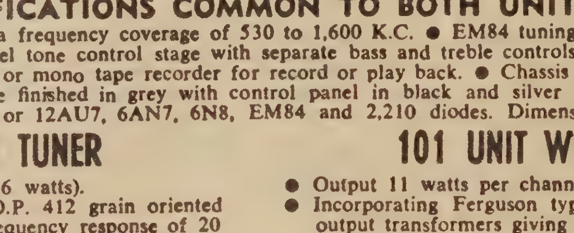

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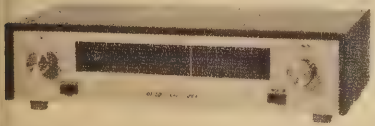

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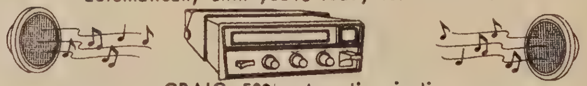

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VARIETY FARE

"ELECTRONICS Australia"
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Devotional & Christmas

HOIRSING, Volume 2. The Paul Mickelson Choir with Charles Magnuson at Piano, Lorin Whitney at Organ. Stereo, Supreme SS-2023. Also available in mono SM-1023. (Supreme Productions Ltd., Box 15, Footscray, Vic.)

Interest: Study, sing-a-long or just listening.
Performance: High standard.
Quality: Good.
Stereo: Normal.

s with Choirsing Volume 1, this ex-ellent disc comes in a de luxe folder ith a book containing the musical rrangements and words of each item. he book makes it possible for anyone sing along with the choir in any of e several parts and gain much enjoyent and practice, without getting out f the easy chair!

And for choir masters, it provides e opportunity to emulate the sounds of aul Mickelson's excellent group. Or, of ourse, one can just listen.

The titles: Victory Through Grace—e is So Great—The Meeting In The ir—Medley: I Know A Name—Medy: My Saviour's Love—I Met God In he Morning—The Unveiled Christ—edley: The Wondrous Story — Jesus ill Walk With Me—Medley: Where e Leads, I Will Follow.

As noted above, the performance is a high standard, with emphasis on e vocal harmony but with effective pport from the two accompanists. iction and quality are good, adding up a record that is enjoyable in its own ght, as well as being a pattern for the ore capable church choirs. (W.N.W.)

* * *

ATHEDRAL ORGAN AND CHIMES. Dr Norman Soreng Wright, Organ; Dr Charles S. Kendall, Chimes. Stereo, Dot (Festival) SZL-931,971. Also available in mono ZL-31,971.

Interest: As per title.
Performance: Capable.
Quality: Somewhat lacking in treble.
Stereo: Normal spread.

At first sight I felt certain that I had eady reviewed this record. It trans-ed, however, that I was confusing it th an earlier recording by the same o musicians "Hymns, Organ And imes" SZL-931-534. This was devoted inly to simple Gospel hymns, pre-ited with the chimes well to the e and using an organ that could have en a lightly voiced pipe instrument or elaborate electronic; it was hard to l.

n this new recording, side one fully justifies the title with a massive and well played cathedral organ dominant and lending real weight to a selection of grand old hymns. But side two reverts to the formula of the earlier record and to much less convincing performances which I suspect belong to the earlier situation.

On side one: Christ The Lord Is Risen—Holy, Holy, Holy—O Worship The King—Joyful, Joyful We Adore Thee—A Mighty Fortress—The Spacious Firmament—All Hail The Power—Onward Christian Soldiers.

On side two: In The Garden—God Will Take Care Of You—The Old Rugged Cross—Saviour Like A Shepherd Lead Us—The Church In The Wildwood—I Need Thee Every Hour — Sweet Hour Of Prayer—God Be With You.

As to the combination of organ and chimes, I must leave it to the individual to decide and this will largely determine your reaction to the album. It's the kind of sound that you either like or don't like. (W.N.W.)

* * *

THE SOUND OF CHRISTMAS. Al Hirt, trumpet. Arranged and conducted by Dick Hyman. RCA Dynagroove 12-inch stereo, LSP-3417. (Also in mono, on LPM-3417.)

Interest: Pop trumpet in Christmas mood.
Performance: Bright and cheery.
Recording: Excellent.
Stereo: Smooth, wide.

The famous "honey horn" of Al Hirt goes Christmassy on this new disc from RCA. Aided by a chorus, a band and conductor-arranger Dick Hyman (on loan from Command Records), Big Al blows his way through some twenty-two tunes of the Christmas season — both sacred and secular. And the result is some very pleasant listening. Tastefully "traditional" in the sincere songs, bubbling over with goodwill and fun in those of a festive nature, Al's playing certainly seems to add meaning and depth to both aspects of Christmas.

Side one has the more relaxed songs: Nutty Jingle Bells—I Saw Mommy Kissing Santa Claus—Here Comes Santa Claus—Rudolph, The Red-Nosed Reindeer—Sleigh Ride—Silver Bells — The Christmas Song—Santa Claus is Comin' to Town—Deck The Halls—Good King Wenceslas—We Wish You a Merry Christmas. While side two has the more sacred: Ave Maria (Schubert)—What Child Is This?—Oh Little Town of Bethlehem—It Came Upon a Midnight Clear—O Holy Night—Silent Night—Hark! The Herald Angels Sing—Joy To The World—O Come, All Ye Faithful—We Three Kings of Orient Are—The First Noel.

A Christmas record that's somewhat different from the usual, to be sure; but one which is well worth a listen. Even those who are not regular Hirt fans should find lots in it to enjoy.

The recording is excellent, with clean crisp sound and smoothly spread stereo. (J.R.)

* * *

CHRISTMAS WITH GEORGE BEVERLY SHEA. Vocal with Orchestra and Chorus. Stereo, RCA Camden CAS-850. Also available in mono CAL-850.

Interest: Bev. Shea's Christmas.
Performance: Characteristic.
Quality: Reasonable.
Stereo: Simulated only.

George Beverly Shea, the tireless Gospel singer from the Billy Graham evangelistic team, has added yet another album to his already imposing list on the RCA and Camden labels. What more can one say, beyond the fact that this is an entirely characteristic performance by one who is so widely esteemed for his dedication and sincerity.

The titles: O Holy Night—O Little Town Of Bethlehem — Thou Did'st Leave Thy Throne—C-H-R-I-S-T-M-A-S—Put Christ Back Into Christmas — Go Tell It On The Mountain—Wonder As I Wander Out Under The Sky — Silent Night—Christmas, Christmas — Away In A Manger—Once In Royal David's City—Sleep Precious Babe.

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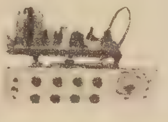

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Technically, the quality is fair only, at least in the simulated stereo pressing which I reviewed. The sound is biased towards the bass on the left, treble on the right, the latter with more than its share of distortion, at least on a wide range system.

Not wildly enthusiastic. (W.N.W.)

★ ★ ★

KOREAN ORPHAN CHOIR, presented by Dr Bob Pierce. A Concert of Christmas Music., Word WST-8124-LP. (Gospel Film Ministry.)

Interest: Children's Choir.
Performance: Full of charm.
Quality: Good.
Stereo: Ample spread.

Among this year's Christmas releases, you will find plenty that are more jolly, more boisterous, more sophisticated but I doubt that you'll find one that has more simple charm.

The 34 children featured are all South Korean orphans selected for musical training from 151 orphanages conducted by the "World Vision" missionary organisations under Dr Bob Pierce. The recordings were made during a recent tour by the choir throughout Asia, the Orient, Europe and North America:

It Came Upon The Midnight Clear — Angels Over The Fields Were Flying — Away In A Manger — Praise Ye The Lord Of Hosts — The First Noel — O Come, O Come Immanuel — Sing We Noel — Silent Night, Holy Night — I Heard The Bells On Christmas Day — O Little Town Of Bethlehem — The Little Drummer Boy — Jingle Bells — Beside The Cradle Here I Stand — Hark The Herald Angels Sing — O Holy Night.

As I said, simple and charming (W.N.W.)

★ ★ ★

HAVE A HAPPY HOLIDAY. Lorne Greene, with chorus and orchestra directed by Joe Reisman, Stereo, RCA LSP-3410. Also available in mono, LPM-3410.

Interest: Christmas and all that.
Performance: Much better than expected.
Quality: Excellent.
Stereo: Good.

I was so horrified by the "singing" on he last Lorne Greene disc that I attempted to review, that I approached his one with the greatest possible reservation. Perhaps that's why I was agreeably surprised!

Side I is given to a quite excellent narration by Lorne Greene of Clement C. Moore's poem "Twas The Night Before Christmas," and the O. Henry tory "The Gift Of The Magi." This, you may recall, is the whimsical tale of a young husband who sold his prized watch to buy his wife a set of combs; he, meanwhile, had sold her long resses to buy him a watch chain!

On side II is a brief group of Christmas songs with Lorne Greene solidly backed with an excellent chorus: Not bad, if you can accept the anomoly f "Jingle Bells" pitched way down to uit a bass voice!

The follows "A Christmas Cantata," n excellent narration of the Christmas tory punctuated by traditional carols, with chorus and orchestra.

Well worth consideration anyway but sure pick by anyone with a soft spot or the man from the Ponderosa. W.N.W.)

DRUMMER BOY, The Living Voices. RCA Camden, Stereo CAS-911. Also available in Mono CAL-911.

Interest: Mainly secular songs.
Performance. Pleasing.
Quality: Good.
Stereo: Well spread.

This is one of those "something for everybody" discs, including as it does conventional carols, traditional Christmas songs and the more modern variety straight out of "Tin Pan Alley." All are nicely arranged by Anita Kerr and skilfully sung by an accomplished group of singers.

Although the disc is named after the beautiful carol "The Little Drummer Boy," there are only two devotional songs in this selection so if you want mainly secular music, this could be your choice of a Christmas record. Sound quality and stereo separation are quite up to standard.

Track titles are: Medley (Jingle Bells, Sleigh Ride) — A Holly Jolly Christmas — Medley (Silver Bells, Little Christmas Tree Waltz) — Be a Santa — Medley (Pine Cones and Holly Berries, It's Beginning to Look Like Christmas, We Wish You a Merry Christmas) — The Little Drummer Boy — Do You Hear What I Hear — I Heard The Bells on Christmas Day — Blue Christmas — What Are You Doing New Year's Eve? (H.A.T.)

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THE TRAGICAL HISTORY OF DR FAUSTUS, by Christopher Marlowe. Richard Burton and members of the Oxford University Dramatic Society. HMV 12-inch stereo, OASD 2270. (Also in mono, on OALP 2270.)

Interest: Famous Elizabethan tragedy.
Performance: Much pruned.
Recording: Very good.
Stereo: Used well.

A friend of mine is rather famous for his over-zealous pruning — after a typical session his garden consists mainly of a collection of variously coloured and textured twigs emerging briefly and nakedly from the ground. Listening hopefully to this recording of Marlowe's classic tragedy on the basis of an admittedly faded mental picture dating from uni studies some years ago, I could not help but be struck by the formal resemblance between it and the aforementioned garden.

Upon checking the definitive O.U.P. Tucker Brooke edition I found this impression was well founded: the recording is indeed quite heavily cut.

Too heavily cut, to my mind; for although Burton and the other members of the cast put quite a lot into their parts, the recording really fails to capture the essential irony of the play in its currently accepted form. Compression of the thing into a bare 40 minutes has meant the omission of virtually all the material showing how

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Faustus fritters away his dearly-paid-for powers on trivialities; not only this, ut also excluded is the significant ddition in the 1616 and later quartos vhere Mephistopheles reveals to Faustus hat he has tricked him into despairing hope of redemption, with the mportant implication that the latter is herefore not entirely responsible for is fate.

The inevitable result of these cuts is hat the listener is left with a naive 'morality play" version of Marlowe's vork, and is therefore unmoved at austus' final doom. To me this seems articularly disappointing in view of the act that Marlowe's plays in general, nd Faustus in particular, were among he first to be more than just morality essons.

It would appear that the Oxford performance from which this recording was aken was of the complete O.U.P. version. If this is the case it seems to me great pity that the recording does ot feature the full performance.

As it stands, I cannot help but feel at the recording will be of value only those students of Marlowe both with ccess to the written work and with e tolerance and good humour to overlook the heavy pruning.

If you're still interested, the recording uality is very high and the stereo is sed to good advantage.

For the dedicated student only. (J.R.)

* * *

OLDEN WEDDING and other Woody Herman favourites. Woody Herman and his orchestra. Festival Stereo. SDL-931,923. Also available in Mono DL-31,923.

Interest: Jazz and blues.
Performance: Authentic.
Quality: Good.
Stereo: Average.

These are some of Woody Herman's ost successful jazz and blues numbers, resumably collected from previous recordings, although no information is iven on this point in the sleeve note. owever, to judge by the generally good und quality, the recordings are f recent vintage. Woody and his boys ally "go to town" with their boisterous zz renderings and show just how moody ey can get with their blues style. Blues d jazz devotees should find this disc their liking.

Woodchoppers' Ball — The Golden edding — Who's Dat Out Dere — ardbird Shuffle — Down Under — dian Boogie Woogie — Blue Flame— our or Five Times — Irresistible You— hips' Boogie Woogie — Las Chipanes — Woodsheddin' With Woodie. .A.T.).

* * *

HE ACADEMY AWARD SONGS. Henry Mancini and his Orchestra. Two-disc set. RCA Dynagroove, Stereo LSP-6013 or Mono LPM-6013.

Interest: Award-winning film songs.
Performance: Lush but rather featureless.
Quality: Excellent.
Stereo: Good spread.

Henry Mancini, a three-times Oscar inner himself, was chosen by RCA to ake this two-disc set featuring every e of the 31 songs which have received cademy Awards since the first award 1934.

Perhaps I expected too much of this mbination, but I regret to say that I found the results disappointing. The set starts out well enough, with a stylish arrangement of Mancini's own "Moon River," but as the numbers follow each other they all seem to lose their individuality in Mancini's all-alike arrangements and the sameness of the treatment accorded to each number — basically singing strings plus mixed choir.

The result is that the music has a "Muzak" quality of the anonymous variety piped around large buildings as a pleasant background. It seems to me that these discs would be very suitable for this purpose and make excellent music of the "whistle while you work" variety, but for an evening's listening, I suggest something with a bit more character.

In all other respects, the discs are quite up to Dynagroove standard, with excellent sound and good stereo separation.

Space does not permit quoting all the 31 titles, but take my word for it you will certainly know more than 90 per cent of them. A few have passed almost into oblivion in the passing years. (H.A.T.)

* * *

OLE! OLE! Herb Alpert and Tijuana Brass. A and R (Festival) Stereo and Mono, U784.

Interest: Current hits.
Performance: Mainly good.
Quality: Very Good.
Stereo: Normal spread.

Most of this disc is very good stuff, as good as anything Herb Alpert has given us, but like the well - known curate's egg, it is only good in parts! There is a noticeable tendency to experiment by Herb with his trumpet in producing unusual sound, and possibly he is looking for variations on the successful Tijuana Brass theme. However, this does not explain why, in some places, Herb plays palpably flat notes, or why the timing becomes rather ragged here and there. I suppose, that like the rest of us, Herb has his off-days.

However, don't be put off by these criticisms if you like the Tijuana Brass, as these lapses occur only in a few places. For most of the time the Brass plays as well as ever, while the sound quality and stereo arrangement are quite as good as in the other Tijuana Brass discs.

El Presidente — All My Loving — Angelito — Salud Amor Y Dinero — Numero Cinco — Aidos Mi Corazon— Struttin' With Maria — Let It Be Me — Acapulco — Limbo Rock — Crawfish — Quiet Tear. (H.A.T.)

* * *

THE TOP HITS GO INSTRUMENTAL. King Curtis and his Orchestra. Atlantic (Festival) Stereo SAL-932, 029. Also available in Mono.

Interest: Top hits.
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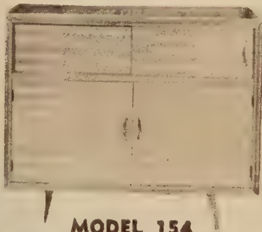

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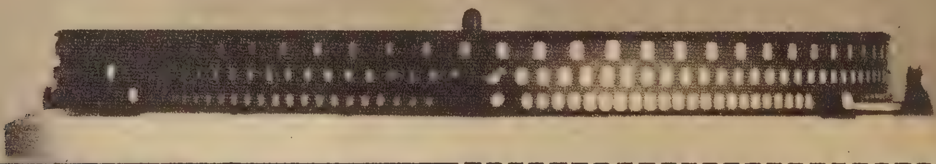

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also renowned as a composer, arranger, singer and guitarist.

However, it is as leader of his own orchestral combination that Curtis is most famous, and hearing this disc it is not difficult to see why. This is very good playing indeed and the arrangements are excellent.

On this disc, Curtis plays the saxella, which is basically a soprano sax, but is longer and has a rather richer tone. This tone suits very well the soulful style of execution which is a feature of King's playing. To hear this at its best, listen to his versions of "Michelle" and "What Now My Love," although I must add that every one of the 12 tracks is a pleasure to listen to, which is not always the case in these days of LP discs.

The titles: The Shadow of Your Smile — Michelle — Cryin' Time — I Left My Heart In San Francisco — Moonglow — Spanish Harlem — You've Lost That Lovin' Feeling — What Now My Love — And I Love Her — Make The World Go Away — The Girl From Ipanema — On Broadway. (H.A.T.).

* * *

GIRL IN LOVE. Bud Shank with orchestra conducted by Oliver Nelson. Festival Stereo SFL-932064 or Mono FL-32064.

Interest: Saxophone and top hits.
Performance: Sensitive.
Quality: Very Good.
Stereo: Normal spread.

Bud Shank is another talented young American musician, who can play the whole family of saxophones, but here plays on the sonorous alto instrument. He is accompanied by the somewhat unconventional orchestral group of six violins, four trombones and rhythm secion. This may sound a little odd, but it makes for very effective and enjoyable istening.

Bud plays beautifully the following very pleasant collection of popular tunes: Lady Jane—Summer Wind—The Sun Ain't Gonna Shine (Anymore)—Strangers in the Night—When a Man Loves a Woman—Girl in Love—Don't Go On Breaking My Heart—Everybody Loves Somebody Sometime—Time—The Shinng Sea—Lara's Theme from "Doctor Zhivago"—Solitary Man.

His technique is to put the tune aressingly around the strict-time accompaniment, with considerable artistry and nfallible sense of rhythm. Recommended for a quiet evening at home. (H.A.T.)

BILLY VAUGHN PLAYS STEPHEN FOSTER MELODIES. Billy Vaughn, orchestra and chorus. Stereo, Dot (Festival) SZL-931983. Also available in mono ZL-31983.

Interest: Much Vaughnted Foster!
Performance: Tuneful.
Quality: Completely clean.
Stereo: Excellent spread, separation.

It's hard to imagine Stephen Foster sounding anything but tuneful, but Billy Vaughn adds to the total effect with singing strings, woodwinds and chorus. Where called for, he lets go with some lively banjo but always with due care to safeguard his "easy on the ear" formula:

Jeannie With The Light Brown Hair — My Old Kentucky Home — Oh Susanna — Massa's In De Cold, Cold Ground — Nelly Bly — Old Folks At Home — Beautiful Dreamer — Come Where My Love Lies Dreaming — Camptown Races — Old Black Joe — Gentle Annie — Old Dog Tray.

Highly listenable and well up in the top bracket, in terms of recording quality. In fact, a very good album. (W.N.W.)

* * *

THE ENDLESS SUMMER. The Sandals. Festival, Stereo SFL-932,037 Also in Mono, FL-32,037.

Interest: Guitar and Beat group.
Performance: Virile and professional.
Quality: Excellent.
Stereo: Good spread.

This is a disc for teenagers, but it is very good of its type. The tunes have point and the clever arrangements are very well played by the young Sandals group. These youngsters play with all the aplomb of experienced professionals. The interest (for teenagers) is heightened by the frequent use of sound effects which I took to be motor bike engines but could equally well be sports cars or motor boats.

As usual, when faced with a record intended for a younger age group, I enlisted the aid of a group of teenagers, and their was no doubt about their obvious enjoyment and enthusiasm.

Anybody thinking about buying a teenager a record as a gift could well add this one to their list of possibles.

The titles: Scrambler—6-Pak—Driftin —Theme from "The Endless Summer" Good Greeves—Decoy—Out Front —

"MOVING" PERCUSSION

PERCUSSION, PLAYFUL AND PRETTY. Bob Rosengarden and Phil Kraus, with their Orchestra. Stereo, Reader's Digest/RCA CSP-113. Also available in mono CPM-11.

Interest: Melody and rhythm.
Performance: Tops.
Quality: Tops again.
Stereo: Gimmicked plus!

Somehow, this one-dollar promotional LP from the Reader's Digest Association got left behind other reviews in the series but it's well worth a dollar of anybody's money, who has the vaguest interest in this kind of sound—or a stereo system to show off!

Bob Rosengarden and Phil Kraus need no introduction as exponents of rhythm-rich sound, which is nevertheless highly listenable. And very well performed, too!

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The titles: For Want Of A Star — Mr Ghost Goes To Town—Johnny One Note—Chloe—All Through The Night — Satan Takes A Holiday — Sophisticated Swing—The Comedians — Speak Low — The Continental Carnival—Goofus.

As I said, if you have a stereo system that you want to show off, this one will do it just fine! (W.N.W.)

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For the record, "The Endless Summer" is a film about surfing which as far as I know has not been released for exhibition in Australia. The sleeve note is a bit vague on the point, but I gather, that only the title track is linked directly with the film. (H.A.T.)

* * *

DANCE PARTY. Xavier Cugat and his Orchestra. Universal Record Club, Stereo and Mono U-764.

Interest: Popular.
Performance: Standard.
Quality: Good.
Stereo: Normal.

The "king" of Latin-American music here offers 40 minutes of non-stop dance music in the South American style, suitable for a festive occasion. The titles are all past or present popular numbers, and cover a wide range of tastes, presumably because it takes all sorts to make a party, and they must all be catered for: Love Me With All Your Heart—Thunderball—A Lover's Concerto — La Yenka — Adios, Adios — Hang on Sloopy—Tabasco—Cu-Cu-Rru-Cu-Cu-Paloma — Judith — Yesterday —Soul Sauce—Zip-A-Dee Doo-Dah.

"Cugie" has been in the business a long time (in fact, he claims his was the original Latin-American orchestra) yet his playing still retains the sparkle and joviality that first shot him to the top. This is certainly as good as any other of his discs that I have heard, and of course is available at the special club price to members. (H.A.T.)

* * *

VIVALDI: The Four Seasons. Ruggiero Ricci, solo violin and conducting the Stradivarius Chamber Orchestra; featuring 14 rare Stradivari instruments. Universal Record Club 12-inch stereo, SUC-691. (Also in mono, on UC-691.)

Interest: Baroque program music.
Performance: Warm, buoyant.
Recording: Excellent.
Stereo: Smooth.

Although one hardly needs an excuse or recording another version of Vivaldi elightful Four Seasons concerti, this isc has not one but two "excuses": t features world-famous violin virtuoso Ruggiero Ricci, and both soloist and rchestra play historic Stradivari instruments.

Not that the disc needs excuses; far om it. The playing is warm, buoyant and in the best Baroque tradition. It compares very, very favourably with all the other versions of these works that I have heard. A most enjoyable performance indeed.

A particularly enjoyable feature is that in each of the four concerti Ricci uses a violin especially suited to the mood by virtue of its tone and/or its period in the maker's life. Thus in "Spring" he uses the light-sounding "Spanish" Stradivari from the early part of the maker's life, while in "Winter" he plays "ex Kreisler" — a rich and mellow instrument made in 1734, three years before Stradivari's death. The aptness of the violin tone to the mood of the music is quite striking, and adds considerably to the enjoyment of the whole performance.

The recording is of excellent quality, making the disc fine value for money. Warmly recommended. (J.R.)

* * *

BALALAIKA. David Parker, with guitar group and percussion. Stereo, Festival SFL-931,933. Also available in mono FL-31,933.

Interest: Probably the balalaika.
Performance: Unobtrusively impressive.
Quality: Above criticism.
Stereo: Well separated.

According to the jacket notes, this whole disc is in the nature of an experiment but one would judge it to have been successful.

David Parker, a guitarist with a background ranging from classical, through Latin to Folk, has adapted to the Balalaika, a three-stringed Russian instrument from which he coaxes sound reminiscent of guitar, mandolin, zither, the Greek bouzoukia and the Brazilian cavanquinho. (These last two names from the notes).

He is backed by three dedicated guitarists, Maxine Parker, David Johnson and Mike Furry, and by percussionist Hal Blaine, who contributed jingles and tinkles far removed from the stylised drum rhythms.

In all, it's a gentle, interesting, rhythmic sound which will yield to analysis for its variations in style or, equally, reward the casual listener.

The titles: The Greek's Tale — Caravan — Sukiyaka — A Taste Of Honey — Fiesta De Los Patos — Never On Sunday — Coffee Pot — El Dorado — Maria Elena — Theme From America, America — Washington Square.

A very likable and listenable disc. (W.N.W.)

EXCELLENT" LABEL

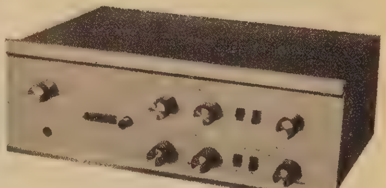
PERSUASIVE PERCUSSION, 1966. Festival (Decca, U.S.A.) stereo SNDL-931,941.

Interest: Percussion showcase.
Performance: Sparkling.
Quality: The best.
Stereo: Demonstration standard.

It is not often I feel moved to use the much abused word "fabulous," but I can apply it to this disc, which I found impossible to fault in any way. The unnamed band plays 12 past and present popular favourites in faultless and elegant style, while arrangements, technical quality and stereo all qualify for an "excellent" label.

As the title implies, percussion plays a big part in the arrangements, but the qualifying word "persuasive" is also entirely apt, and the "boom, boom, rattle, rattle" technique still favoured by some percussionists is entirely absent on this disc. Instead, the listener is treated to a restrained exhibition of skilful percussion which is very enjoyable.

Here are the titles: Autumn Leaves — Istanbul — People — This Can't Be Love — September in the Rain — Everything's Coming Up Roses — Caravan — Bye, Bye, Blues — Rain — Tonight — Who Can I turn To — Never On Sunday. (H.A.T.)



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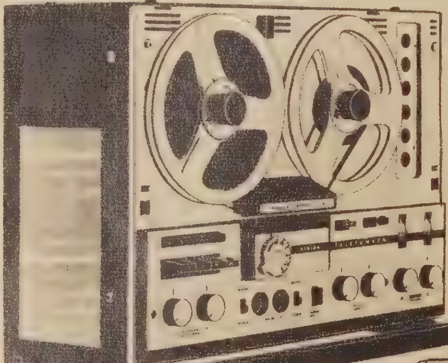

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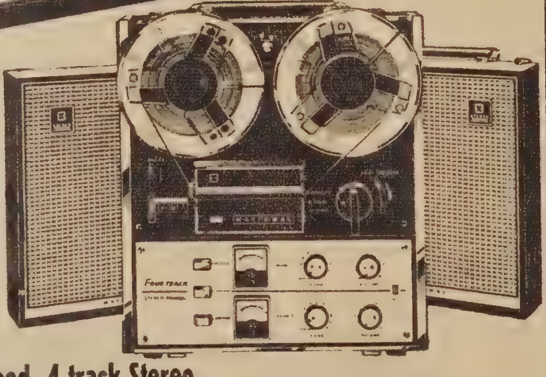

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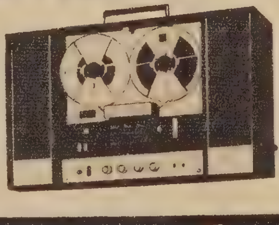

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E. POWER BIGGS PLAYS MOZART. The 17 Festival Sonatas for Organ and Orchestra. Zoltan Rozsnyai conducting the Columbia Symphony. CBS Masterworks 12-inch stereo, SBR-23159.

Interest: Mozart organ works.
Performance: Warm, vivacious.
Recording: Excellent.
Stereo: Widely spread.

Another recording from the ever-active American organist E. Power Biggs and further testimony to his dedication to the task of popularising the classic organ and its music. More power to him! (No pun was intended—sorry).

This time we hear the delightful little organ sonatas of Mozart, written, as M Power Biggs tells us in the sleeve notes when the composer was organist at Salzburg Cathedral. The maturity of these happy little works is deceptive, for when the first was written Mozart was only 11 years old; he was only 24 when the last was composed, in 1780. They are beautiful little single-movement sonatas reminiscent of the church sonatas o Arcangelo Corelli and Handel's orga concerti, but at the same time distinctively Mozartian in their fusion of lightness and depth.

The recording was made in the Stadtpfarrkirche of Eistenstadt, in Austria — only about 160 miles from Salzburg The organ is a reconstructed Mallo tracker action instrument. A modes organ of two manuals and pedal, wit but 18 stops, yet one of delightful cla ity and sonority. The composer Hayd was a frequent player of the same instrument.

Power Biggs and the Columbia Symphony under Zoltan Rozsnyai play extremely warmly. The organ and orchestr are very well balanced, and it is har to imagine how they could have don the works better justice. Very pleasa and satisfying listening.

The recording quality is extremely hig with smooth bass and transparent trebl and smoothly spread stereo. Altogethe a disc which can be warmly recommended. (J.R.).

* * *

MUSIC FOR THE THEATR ORGAN. No. 2 Fredric Bayc at the organ of the Gaumont Sta Theatre, Kilburn. Mono HM OCLP-3505. Also available stereo, OCSD-3505.

Interest: As per title.
Performance: Very capable.
Quality: Clean but with noticeab ambient noise.

As the title suggests, this is the secor album presented by EMI and Fredr Bayco under the title "Music for t theatre organ."

In his own notes Fredric Bay writes: "Like its predecessor, this r cording follows a predetermined patte of presenting light music on the theat organ . . . and deliberately avoids the u of effects frequently associated with t instrument, particularly in the ea days, when it was expected to emula such noises as crockery smashes, f horns . . . no one will deny that the things served their purpose . . . yeste year. Now, decades later, these ne vulgar whimsies have been discard and the theatre organ continues to ma tain its rightful place as a medium f the exposition of light music."

Suiting the selections to the then he presents: Poupee Valsante, Chans de Matin—Parade Of The Tin Sold

—Rosamund, Fairy Frolic—Narcissus —Marche Militaire—Barcarolle—Dance f the Ostracised Imp—Carminetta — hepherd's Hey—Pierrette—Rosemary— 'arantelle.

Technically, the sound is clean, hough a trifle remote at times and conaining a noticeable amount of building umble and other stray noises, which ease abruptly between tracks. I doubt, owever, that this will deter enthusiasts f the theatre organ, particularly those vho appreciate the type of music preented, as distinct from the more gimnicked variety. They will certainly revel 1 the weight of the bass from this big -manual instrument which, according) the notes, is one of the few theatre nstruments in the world still mainained in its full and original condition. W.N.W.)

★ ★ ★

HE HAMMOND BROTHERS. Super Spectacular Stereo Sound. Stereo, Festival SFL-932,025.

Interest: Hammond organs; two, no three of them!
Performance: Well co-ordinated.
Quality: Good.
Stereo: Three distinct channels.

Who or what are the Hammond others?

The term could refer to the three gans used for the recording—a Conrt Model, a de luxe Spinet and a ammond Transistor Organ. Or it could fer to the Belgian organists Jan D. ef and Co Pilley.

The disc itself, by the way, was proiced in the Decca studios at Brussels, ider the auspices of Eurovox Music.

The organists do not attempt to verge much from familiar Hammond icings, but they are individually very ept and they combine most impresely to swap the melody and echo ects from one organ to the other, even the middle of phrases.

In the phantom centre channel drums d bass provide a foundation of ythm as they run through two Cole rter medleys, two Latin Hits medleys, foxtrot selection, a group of tangos, group of waltzes and two tracks itled "Exhibition Showcase." In the t of these, the transistor organ is roduced to inject banjo and whistle ects and some Hawaiian guitar.

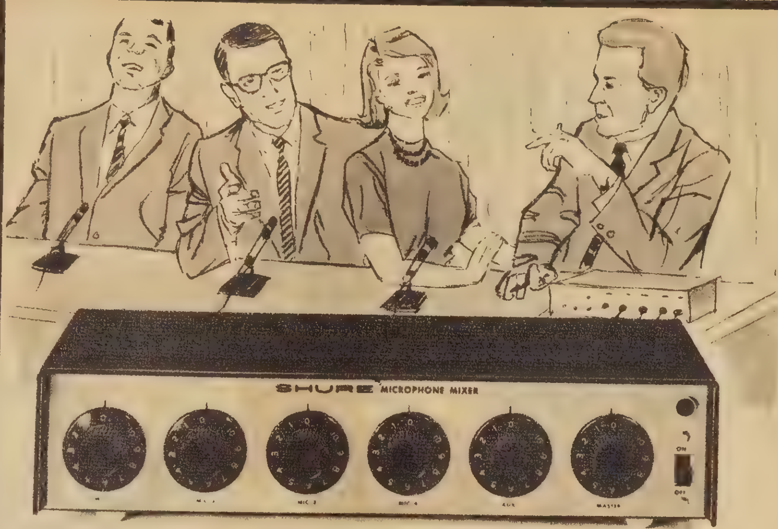
If you like the traditional Hammond ınd, I guess you'll appreciate this um twice as much! On the other ıd, if you dislike the sound, then I ess you'll dislike it in about the same io! (W.N.W.)

★ ★ ★

FAVOURITE THINGS. Lenny Dee. Decca, U.S.A. (Festival) Stereo, SDL-932,020. Also in Mono, DL-32,020.

Interest: Popular organ.
Performance: Skilfully executed.
Quality: Very good.
Stereo: Wide and smooth.

here is no sleeve note with this disc, I cannot provide information about ny Dee, or what type of organ he laying. However, I can say that he 's most entertainingly, with skill and ing. Moreover, his carefully chosen gram provides for variations in mood style, which sustains the interest through: Down Town — Unchained ody — My Favourite Things — etty Organ (Yaketty Sax) — umn Leaves — More — My Kind Town — The Good Life — A Taste Honey — Misty — Red Roses For



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SPECIFICATIONS

Gain: At 1,000 HZ (cps).

Input	Outputs		
	Low Imp. Mic.	High Imp Mic.	High Imp. Aux.
Low Imp Mic .5 mv produces	+9 db 1.4 mv	+33 db 22 mv	+60 db 500 mv
High Imp. Mic. 5 mv produces	—13 db 1.1 mv	+ 11 db 18 mv	+38 db 400 mv
AUX. 50 m. produces	—35 db 0.9 mv	—11 db 14 mv	+16 db 320 mv

Frequency Response: The frequency response is flat plus/minus 2 db from 30 Hz (cps) to 20,000 Hz (cps).

Hum-Noise: 70 DB below rated output.

Equivalent Input Noise: 150 ohm source, 123 db below 1 volt.

Input Impedance: Microphone inputs suitable for high or low impedance dynamic and ribbon microphones. Auxiliary-50,000 ohms.

Recommended Load Impedance:
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High Impedance Microphone
.. .. 20,000 ohms or greater
Auxiliary High Impedance
.. .. 50,000 ohms or greater

Distortion: Less than 1 per cent total Harmonic Distortion when low impedance microphone output is at 20 mv level, high impedance microphone output is at 200 mv level and Aux. high impedance output is at 2.0 volt level.

Output Clipping Level:

Output	Min. Clipping Level
Mic. Low Impd.	60 mv
Mic. High Impd.	.85 volts
Aux. High Impd.	4.0 volts

Operating Voltage: Model M68-2 105-130 volts 50/60 cycle or 210-240 volts 50/60 cycle.

Net Weight: 4 pounds.

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Additionally, six bandspread short wave ranges are provided, shown on a separate scale with a rotating drum selector. The Satellit is fitted with 17 transistors and 11 diodes. It features a short wave fine tuning dial, automatic frequency control on FM, R.F. stage, a switchable ferrite aerial, a double extension telescopic aerial, a separate control for the bandspread short wave tuner, duplex drive on FM/AM, a tuning and battery indicator, and two multi-octave loudspeakers. The Satellit also has an illuminated tuning scale and separate bass and treble controls. Sockets are provided for headphones, external aerial and earth, car aerial, record player, tape recorder and external battery power supply.

The Satellit transistor 5000 has a handsome padded graphite case with chrome and satin silver trim. It measures 16" x 10" x 4¾".

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The Ocean Boy TR3000 is not just a transistor radio, it is a perfect piece of precision engineering. The whole world's your oyster with the Grundig TR3000. Choose a wavelength by pressing one of the nine buttons and using the fine tuning control. See visually when you are at the point of best reception by the tuning indicator (which doubles as battery indicator). Adjust the bass and treble tone controls and you're hearing a radio that's built for listening to, not straining at. The Ocean Boy has two loudspeakers, 13 transistors, 8 diodes and 2 rectifiers. Provides matchless listening on VHF/FM, long, medium and 4 short wavebands (10 to 185 m.). Output is up to 2 watts (R.M.S.).

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GE:

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A Blue Lady — One Of Those Songs.

Mr Dee tends to use the pedal bass ather sparingly, and to use the upper egisters a lot, so some people may think he instrument's tone to be rather on he thin side. However, he is sustained hroughout this recital by some excellent nstrumental accompaniments provided y an anonymous group. The record lso has the advantage of extremely lean sound and excellent stereo separaion which spreads both the organ sound nd the accompanying instruments idely and smoothly.

A good one for those who like popular rgan recitals. (H.A.T.)

* * *

OUND OF THE SAROD. Ali Akbar Khan, sarod, with Miss Sheela Mookerjee, tamboura, and Shankar Ghosh, tabla. Recorded in concert. Festival 12-inch stereo, SFL-932,001. (Also in mono, on FL-32,001.)

Interest: Indian music.
Performance: Moving, if unfamiliar.
Recording: Excellent.
Stereo: Smooth.

A recent addition to the all-too-sparse nks of recordings of Indian music, ith distinguished musician and comoser Ustad Ali Akbar Khan playing e large 25-stringed instrument percted by his father, Dr Allauddin Khan. hose for whom the name is unfamiliar ay be interested to learn that Ali kbar Khan has composed the music r many famous Indian films, including tjajit Ray's "Devi." In recent years has given many concerts in capital ies throughout the world, all with eat success.

On this disc, recorded "live" at a ent concert, he demonstrates both the riguing beauty and versatility of the rod in the hands of a master player, d the quite moving beauty of Indian sic, once one has become accustomed the unfamiliar constructions and ects. Here poignantly sad and restrain-, there sensually rhythmic, it can be y rewarding.

Together with Miss Sheela Mookerjee Shankar Ghosh, he plays two ragas, ga Chandranandan and Raga Kirwani. e first consists of an alap in 15 parts, lowed by a short gat in tala jhaptal; the second of a slow gat in tintal 16 beats (Jor) followed by a fast gat also in tintal 16 beats (Jhala).

The recording is of excellent quality, and the stereo smooth.

A most enjoyable recording, and one recommended to all with a taste for Indian music, or a curiosity about same. (J.R.)

* * *

VIOLIN MUSIC OF SCHUBERT. (Sonatinas Nos. 1 and 3, opus 137 and Grand Fantasy, opus 159). Zino Francescatti, violin, with Eugenio Bagnoli, piano. CBS, Stereo SBR 235162.

Interest: Classical Violin.
Performance: Ideal.
Quality: Excellent.
Stereo: Restricted.

These beautiful works, which have been deservedly popular almost since they were first published (although the Fantasie was coldly received at its first performance) are given a performance which to my mind is a model of musical integrity. Zino Francescatti lets the music speak for itself, and does not attempt to pull the phrasing around, or meddle with the composer's dynamic markings, in the search for "artistic expression."

The two Sonatinas are lightweight works written by Schubert when he was only 19, and betray obvious influences of Beethoven, and more particularly, Mozart. Although unpretentious works, with a minimum of development, they abound in delightful melodies.

With the Grand Fantasie we have a work of an entirely different calibre. This is pure Schubert, completed by the composer only a few weeks before his death, written in his most mature style and owing allegiance to nobody. It is alike a challenge to the skill of the performers and a delight to the listener. The piano, which is the earlier works plays a comparatively unimportant role, is given equal prominence here, and for long passages dominates the violin. Eugenio Bagnoli is quite equal to the demands of the complicated score and plays with finesse and feeling throughout. Altogether a delightful record, excellently recorded to the highest present-day standards. (H.A.T.)

LIE IN A NEW ROLE

DON'T GO IN THE LION'S CAGE TONIGHT. Julie Andrews. Arranged and conducted by Robert Mersey. Stereo, CBS SBP-233338.

Interest: "Heartrending ballads and raucous ditties."
Performance: Terrific.
Quality: Brilliant.
Stereo: Used effectively.

As the notes forewarn, this isn't ıe Julie Andrews you learned to now so well as Eliza Doolittle of My Fair Lady." This is another kind f Julie, hinted at in some of her levision appearances, but heard here full advantage. Here she is, back the old music hall situation, with eliciously presented tongue-in-cheek ersions of the old favourites; a kind pot-pourri of Beatrice Kay, Cicely ourtnege, Gracie Fields and perhaps few others.

And equally delicious is the Quartones' barber-shop quartet and the melodramatic orchestrations by Robert Mersey.

Tongue - in - cheek, yes; melodramatic, yes; but so very well done and so thoroughly enjoyable: I Don't Care — The Honeysuckle And The Bee — Mother Was A Lady — Who Threw The Overalls In Mistress Murphy's Chowder? — Everybody's Doin' It — Waiting At The Church — Don't Go In The Lion's Cage Tonight — Burlington Bertie From Bow — Alexander's Ragtime Band — By The Light Of The Silvery Moon — Smarty — She Is More To Be Pitied Than Censured.

Technically, the sound is brilliant and clean, though Julie Andrew's sibilants will find any peak you have in the playback system. But don't let this remark put you off. Turn the treble back a little if you have to, but don't miss hearing this one. (W.N.W.)

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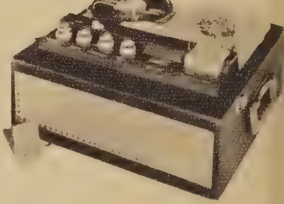

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A recent British technical review says . . . "At last we have an all British recorder which equals the best Continental and Scandinavian products in accurate equalisation and wide frequency response, and which at the same time gives that subtle subjective satisfaction and impression of smoothness and effortless dynamic range which is so difficult to define and measure."

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POPULAR JAZZ

By

GRAEME BELL

JNK JOHNSON AND HIS SUPERIOR JAZZBAND featuring George Lewis and Jim Robinson. Good Time Jazz, Mono. M12048.
Interest: New Orleans jazz.
Performance: See review.
Quality: See review.

A bunch of jazz historians and en-
siasts went down to New Orleans in
12 and rounded up seven old-timers,
ne of whom had not played for many
rs.

n fact, a workable set of false teeth
l a trumpet had to be bought for
ık Johnson a few weeks before this
ording session was made, and when
as observed that George Lewis' clari-
was held together with wire, rubber
ds and chewing gum, Dave Stuart,
wrote the most informative cover
s, rushed out and bought a second-
d clarinet on the spot.

ttempts to hire the city's recording
lio were thwarted because the musi-
is were Negros, so a storeroom was
d for three hours, and nine tracks
virtually no rehearsal were put down
the use of home-made recording
ipment and the last box of a dozen
ates available in New Orleans.

he music reflects all these difficulties,
the sincerity and warmth and the
r joy of playing together again comes
ugh in a rough and honest manner.

he session was of very great his-
al significance, and this is heigh-
d by the fact that the three remain-
acetates were used to cut nine
utes of Bunk's reminiscences.

★ ★ ★

ETHER AGAIN! Teddy Edwards, Howard McGhee, with Phineas Newborn, jun., Ray Brown and Ed Thigpen. Contemporary, Stereo S3588. Also available on Mono.
Interest: Free-blowing jazz.
Performance: First class.
Quality: Very good.
Stereo: Normal.

ddy Edwards, tenor sax and How-
McGhee, trumpet have been on the
since the late thirties, and I recall
; tremendously impressed with the
's playing when my own band
ared on the same jazz festival with
Howard McGhee Sextet in Paris in
.

y Brown, bass, and Ed Thigpen,
s, from the Oscar Peterson Trio,
her with that brilliant young tech-
on piano, Phineas Newborn, jun.,
up the rhythm section.

five musicians are exceptionally
, and there is not a dull moment
ny one of the six tracks, even
h two of these occupy almost 10
tes' running time each.

ntaneous improvision of this nature
plenty of space in which to expand,
t takes musicians of this calibre
tain the musical standard.

re are overtones of the bop era on some of these tracks, which were recorded in 1961 and include Charlie Parker's "Perhaps" and Errol Garner's "Misty."

You can turn your volume right up without the slightest trace of distortion.

★ ★ ★

FIREHOUSE FIVE PLUS TWO—GOES TO A FIRE. Good Time Jazz, S10052. Also available on Mono.
Interest: Revival Dixieland.
Performance: Good.
Quality: Good.
Stereo: Normal.

Fifteen years ago a bunch of Walt Disney illustrators began playing jazz as a hobby. Now the F.H.5 are internationally known for their unpretentions happy jazz and sense of fun.

They have made many albums with many different themes, but this time they have finally arrived at the scene of the fire with "Fireman Save My Child," "The Midnight Fire Alarm," "Keep the Home Fires Burning," "Smokey Mokes" and "Fire! (Turn the Hose On Me)," etc.

The playing of these gents might not set the world on fire, but they achieve most successfully what they set out to do—have fun and generate happiness.

★ ★ ★

DELLA REESE "I LIKE DAT!" AMPAR, Stereo SML-931,889. Also available on Mono.
Interest: Gospel Blues singing.
Performance: Robust and authentic.
Quality: Excellent.
Stereo: Excellent.

If you like hard-hitting blues singing, then you will like Della Reese, who gets right down to business from the first phrase, and let's you have it square between the ears.

She runs through the various moods of gospel singing of today, and no small measure of it is what we used to call blues shouting.

Some of the songs are her own and two are by the late Dinah Washington, but the two which we probably best know are "Travellin' Light" and "Nobody Knows the Way I Feel this Morning."

Bobby Bryant's arrangements and trumpet playing are excellent and, in fact, the entire backing and recording quality cannot be faulted. ■

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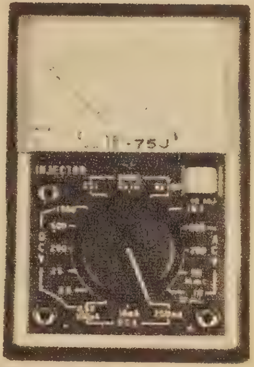

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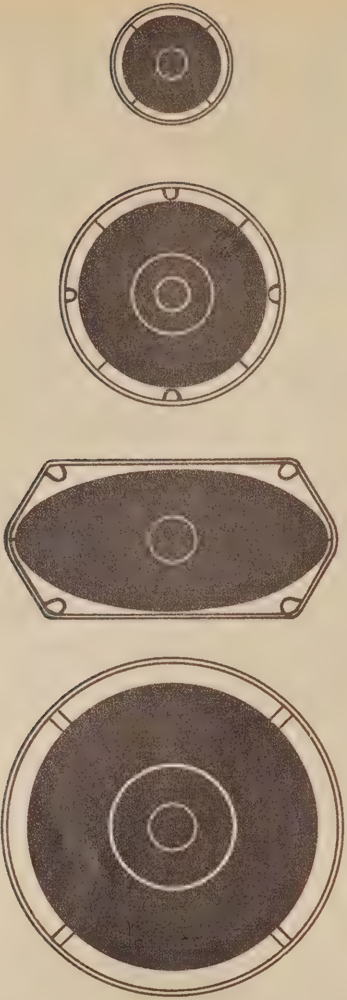

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4D

C4G

5D

C5G

6·4D

C6·4G

6H

C6L

7·5H

C7·5L

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C8·4L

8H

9·6H

9·6HX

C9·6L

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TRADE REVIEWS AND RELEASES

Encel — CSM 40 Stereo Amplifier

The amplifier pictured is the "Encel" Model CSM-40 stereo pre-main amplifier, a compact higher-power design which boasts a high degree of operating flexibility. It was sent for review by Encel Electronics Pty. Ltd., of 431 Bridge Road, Richmond, Victoria, and 257 Clarence Street, Sydney.

Assembled in Japan by the Daiwa Corpor-ion, the unit is in a stout sheet metal case d has an overall size of 10in x 14½in x 5¼in ie wrap-over cover has a grey-brown finish, iile the front and rear panels are in ushed metal with smooth-finish turned etal knobs.

Although the front panel is quite neat, ling is perhaps less satisfying than it might . One reason for this is probably the relati-y large number of controls: there are no s than nine control knobs, together with en slide switches, a balance meter and ee mode indicating lamps. No doubt, with ch a large number of controls to fit on to panel, it would be rather difficult to pro-ce a layout which was really satisfying—t more of this anon.

Apart from the number of controls, the pearance is compromised by the panel tering. The title lettering is somewhat un-enly spaced, with letters in rather anaemic d inappropriate italic font; in addition the e used for control markings is so small it in some cases one must peer at the nel quite closely in order to decipher it. ter units would be considerably improved these shortcomings were corrected.

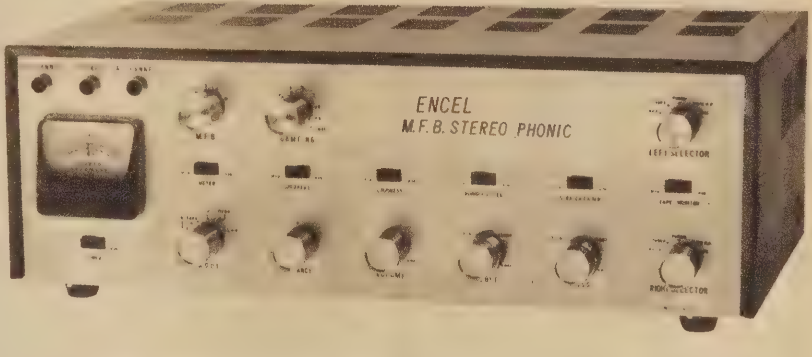
The CSM-40 is a valve amplifier, using in h channel two 6BQ5 pentodes in push-l to give a rated output of 18W RMS fore clipping. A 12AX7 is used in each nnel as feedback mixer and split-load se-splitter. The main channels are pre-led by ½-12AU7's as voltage amplifiers, h 12AX7's as preamps.

The unit provides input facilities for mag-ic and crystal pickup, tape head, micro-one, radio tuner, high-level tape and xiliary. Concentric independent bass and ble controls are used, in a passive con-ration; there are also independent input ector switches for each channel, a balance trol and a mode switch giving all five sible operating modes.

he modes are indicated by the three n indicators above the level meter. One not help wondering whether the indicators ld be required if the control lettering e of a more conveniently read size.

ne of the claimed features of the ampli-is that it provides facilities for motional back ("MFB") in conjunction with the cial two-voice coil speakers required for operation. (The theoretical advantage of B is that by deriving negative feedback ctly from the voicecoil velocity, the ker system is included in the feedback and its nonlinearities thereby correct-To this end there are two additional tpanel controls, marked respectively FB" and "Damping."

hether or not MFB is worthwhile in tice depends greatly upon the special kers. If the feedback is to improve the ormance rather than degrade it, the nd voicecoil must generate a highly rate velocity-proportional signal. There onsiderable doubt as to whether it is omically practical, at present, to con-t such speakers; if it were, the same iques applied to standard speakers d possibly make MFB redundant!



For Australian users the MFB facility will probably be something of a redundancy in any case, as few will be able to obtain the special speakers. In view of this it might have been preferable to omit the controls and circuitry from the CSM-40, thereby lowering its cost and reducing the number of front-panel controls.

In the opinion of this reviewer the balance meter is similarly redundant, although for a different reason. This is simply that if one needs the meter to set the balance, one is fairly obviously incapable of being upset by unbalance — in which case one doesn't need to worry about balancing, with or without a meter!

Really I cannot help but think that balance meters are little more than a rather expensive way of producing a "technical-looking" front panel.

The CSM-40 has output terminals for 4, 8 and 16-ohm speakers; also high-level high-impedance recording outputs which precede the tone controls in the usual way. There is also a mains outlet which is controlled by the amplifier mains switch, although the outlet is of the flat two-pin variety which is of dubious legality in this country.

On listening and measurement tests the sample unit gave quite a good account of itself. Maximum undistorted power output was 17 watts RMS per channel, a creditable performance from push-pull 6BQ5's. Frequency response from the auxiliary inputs was 20-25,000HZ between —3dB points, with distortion at 1KHz and 16W only 1 per cent. Signal-to-noise and channel separation figures were similarly typical of valve equipment in this class. Square-wave response was a little down, as one might predict, but on the other hand stability was excellent.

There was input sensitivity to spare on each of the many inputs, and magnetic pickup and tape head equalisation curves were within accepted tolerances. Using a high-quality magnetic pickup and a pair of bookshelf-type enclosures, the unit gave a performance equal to that of most high-quality valve amplifiers, as one might expect.

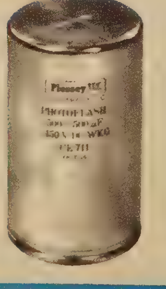
Yet there were a few points which we found disappointing in view of the fairly high pretentions of the unit. The tone controls provide only 10dB of boost, barely enough by modern standards. This is particularly unfortunate in view of another shortcoming: the crystal pickup input consists simply of a resistive divider across the magnetic pickup input so that, for flat reproduction, the tone controls have to be used to "de-equalise." A similar situation exists with the microphone input, which receives the same equalisation provided for tape head. In addition, the tape equalisation includes no treble boost to provide for head losses, again placing further responsibility on the treble control.

While the rumble filter was effective, it was found to start rolling off at about 150Hz (-3dB). Consequently it tends to filter out the fundamental bass as well as any rumble.

The scratch filter seemed notably ineffective for likely requirements, as it was found to do little more than introduce a 6dB dip at about 3KHz.

To summarise: for use as a "straight" stereo amplifier with magnetic pickup and radio tuner, the CSM-40 is certainly capable of performance equal to most valve amplifiers. It has high power handling capacity, quite low distortion and excellent stability. But in the opinion of this reviewer its pretentions to a somewhat greater level of elaboration are compromised by a number of shortcomings as detailed above.

Price of the unit is quoted as $129, and inquiries should be directed to the nearest branch of Encel Electronics. (J.R.)



CAPACITORS FOR ELECTRONIC FLASH

Readers making or intending to make the electronic flash unit described in a series of articles currently appearing in issues of "ELECTRONICS Australia" will be interested to know that the Ducon Division of the Plessey Components Group has imported specially from the parent company in the U.K. a quantity of 500-500uF 450VW photoflash capacitors. A sample of these capacitors submitted by Ducon has been tried in our prototype unit and found to be very satisfactory.

Ducon emphasise that they are unable to supply these units directly to users, but they should be available from normal trade suppliers. The trade price is quoted as $11.45 plus sales tax. A special clamp is supplied for the capacitors.

PHILIPS ELECTRONIC ENGINEER ASSEMBLY KITS

KIT No. EE8 PARTS FOR 8 PROJECTS

Morse Code Practice Set, Gramophone Amplifier, 1 Transistor Radio, Moisture Indicator, Traffic Beacon, Burglar Trap, 2 Transistor Radio, Automatic Night Light.

$19.95

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All the above plus: Electronic Organ, Audio Amplifier, Intercom., Bi-Ampli. Amplifier, Detective's Ear, Pilfering Alarms, Push-Pull Amplifier, Universal Test Circuit, Morse Code Trainer, Time Switch, 3 Transistor Radio, Acoustic Relay.

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Makes up into a 3 transistor mantel radio. Everything supplied including attractive cabinet, battery and screwdriver (the only tool required).

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240/15 volts at 500 m.a.

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Bridge type, Contact Cooled, up to 20 volts at 1.5 amps.

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3 Transistor model. Approved type. Crystal controlled. Frequency 27.24 m.c. Range up to ¼ mile depending on terrain.

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Also available with increased range —5 transistor model.

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Replica of P.M.G. handset—supplied complete with 50ft connecting wire and batteries. Ideal for connecting house to garage, room to room, barn to shed, etc. Loud bell in other phone when dial is pressed. Very clear speech reproduction.

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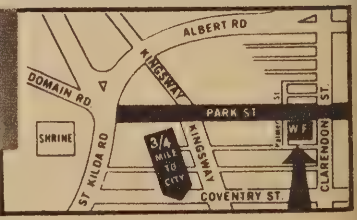

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TRADE RELEASES IN BRIEF

'ARAMETERS PTY. LTD., 1213 1217
gh Street, Armadale, SE3, Victoria, sends
ormation on new instruments produced
the Yokogawa Electric Works, of Japan,
om they represent in Australia.
'hese comprise a sound level meter cali-
ted in dBs with a self-contained oscil-
or which allows the instrument to be
ibrated on site; a portable precision fre-
ency meter with taut band suspension
ilable with a range from 50 up to
Hz with narrow span; a new improved
oratory recording potentiometer with
n folding charts.
'urther details and prices can be obtained
m the importers at the address given
ve.

**TANDARD TELEPHONES AND
BLES PTY. LTD.** has appointed Mr W.
Sparkes manager of defence projects in
stralia and New Zealand. In announc-
this appointment, S.T.C. say it is a
ognition of the need for continuous and
mate contact with affairs governing tele-
mmunications equipment requirements for
three armed Services and the Defence
partment, and the company is looking
ward to the day when defence forward
nning will be available to local industry,
the placing of orders outside Australia
exception rather than the rule.

HANNEL MASTER PTY. LTD. has
ointed Amalgamated Electronics of Port
esby as distributors for the Territory
Papua and New Guinea. At present,
appointment is for the range of Channel
ter television aerials and accessories,
the company says other products could
ncluded at a later date.

LECTRONIC COMPONENTS, 6 Cen-
Avenue, Boronia, Victoria, can supply
mplete kit of coils and IF transformers
the Playmaster 114 program source
ribed in the September, 1966, issue of
CTRONICS Australia. The short-
coils are spire clip mounted, and

de terminals. The type numbers are:
16S, Aerial; SWR16S, RF; SW016S,
lator.
e company asks us to point out that
nellock tools have been temporarily
ort supply because of delays in ship-
from the U.S.A., but that every
effort is being made to fulfil outstand-
rders.

M AUSTRALIA LTD., has announced
v magnetic tape for computer use. Call-
Micro-Clean," the new tape is said to
ase read/write speeds by as much as
0 characters per second on early tape
to 180,000 characters per second on
ape units. Bit densities have increased
200 bpi to 1600 bpi.
proprietary method developed by IBM
esulted in a tape with smooth, uni-
tape surface, which eliminates most
e debris producing oxide protusions
ontaminate tape, the company claims.
se the surface dimensions are consistent over the entire length of the tape, closer contact between the read/write head and the tape surface results in improved signal characteristics.

Further information can be obtained from Communications Department IBM Australia Ltd., IBM Centre, Bradfield Highway and Kent Street, Sydney.

AMALGAMATED WIRELESS AUSTRALASIA LTD., 47 York Street, Sydney, advises that its Engineering Products Division is marketing the new Marconi Instruments FM/AM modulation meter, Type TF2300. The company says this fully transistorised meter is designed to meet all requirements in the fixed and mobile point-to-point communications field and most of those in broadcasting and telemetry.

The carrier frequency range is 4MHz to 1000MHz. Five deviation ranges, from 5KHz to 500KHz are provided with modulation frequency range from 30Hz to 150-KHz. For measurement in the audio band, the modulation frequency range may be restricted to 15KHz by means of a panel control.

Two ranges of AM depth measurement are provided, 0-30 per cent and 0-100 per cent, at fundamental modulation frequencies in the range 30Hz to 15KHz. The modulation frequency range extends to 50KHz for distortion measurements.

A demodulation signal output is available at a level of 1mW into 600 ohms for meter FSD, both for FM and AM signals. A standard 50 to 75uS de-emphasis filter may be switched into the demodulated signal output circuits for measurements on transmitters using pre-emphasis.

COMPACT ENCLOSURE FOR MSP SPEAKERS

In keeping with the very strong current trend toward smaller sized and less expensive loudspeaker systems, a new unit is now being marketed, using MSP loudspeakers.

The new system is obviously aimed at the market falling between large free-standing enclosures and the miniature variety, the latter with limitations which increase as the volume of the enclosure diminishes.

It measures 20 inches high by 11 inches wide, being roughly similar in frontal area to our own Playmaster "Bookshelf" system. It is, however, 8 inches deep, securing a substantial increase in internal volume. The samples submitted for review were in the popular oiled teak finish (veneer over ½-inch flake board) but it is understood that other finishes will be available to suit the more popular furnishing decors.

The actual loudspeakers used have both been developed for the system by MSP, the Manufacturers Special Products Division of A.W.A. The larger unit is an 8-inch single-cone type, 8TAC, having a main cone free-air resonance at about 70Hz. Paired with it is a 4-inch tweeter, type 4MBC, developed from an earlier 4-inch curvilinear unit, which was favourably reviewed some time ago in these columns. Both the 8TAC and the 4MBC are fitted with ferrite magnets and their sensitivities have been arranged so that they pair together without supplementary resistive pads.

The system includes a simple L/C network, crossing over at 6KHz.

The enclosure itself is a vented type with a 2¾-inch diameter circular port to which is attached, internally, a short length of composition mailing tube. In fact, the whole system is not far from being a scaled-up counterpart of the "Mini" system reviewed in these columns last month. Internal damping is provided by a pad of Innerbond attached to the rear lid.

On listening tests, the immediate impact was of a system with rather less emphasis on the extreme treble than our own Bookshelf system but with somewhat more weight in the middle register. Output at the bass end appeared to be adequate, without undue dependance upon bass boost from the amplifier.

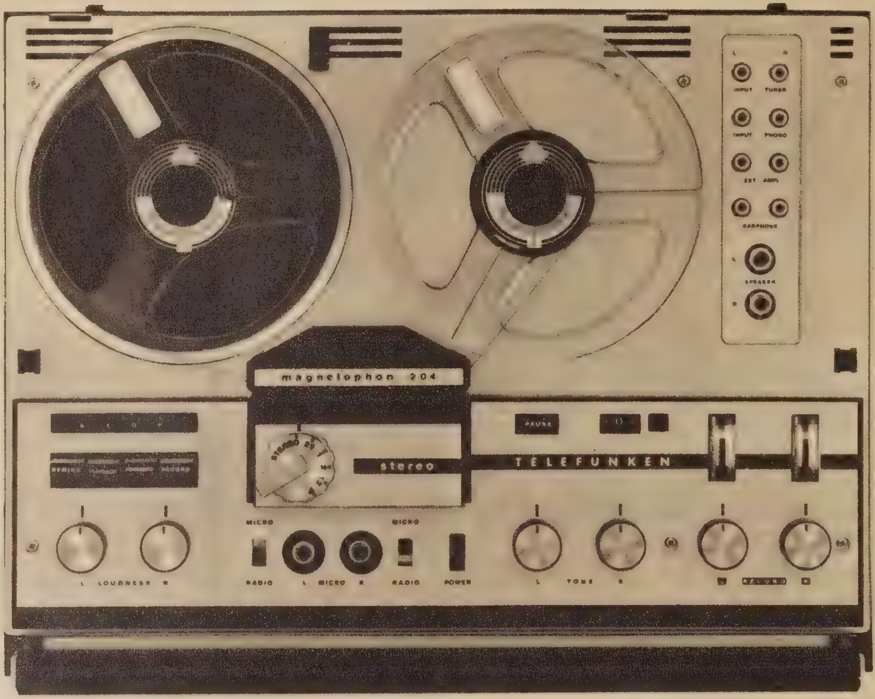
Overall acoustic efficiency appeared to be about average and power handling capacity on program material adequate for all likely domestic requirements. In short, it could be defined as an easy-to-use, compact system, with good frequency coverage and readily usable with all classes of domestic playback equipment.

Closer examination of the bass response with a variable frequency generator revealed an impedance peak at about 125Hz with another and much lower amplitude peak at about 50Hz. Acoustic output is well sustained down to the 100Hz region and it is from this region that the system derives most of its "weight" in the bass register. Below 100Hz output tends to taper off but, probably due to the less restrictive enclosure, without any undue tendency towards frequency multiplication.

A point of criticism is that, in the prototype units submitted for review, the face cloth over the port tended to vibrate with an audible buzz, when the system was fed with any substantial level of signal in the 50Hz region. In fact, there was reason to believe that the very presence of the cloth across the port was modifying the "Q" of the system. At the very least, it would appear necessary to glue the cloth to the baffle face to prevent the audible buzzing. We understand that the matter will be attended to in all production units released for sale.

The units are being manufactured in the first instance by Messrs Broadway Electronics but are being retailed throughout the Commonwealth by high fidelity equipment dealers and A.W.A. distributors.

The price is quoted as $49.50 retail, somewhat less in kit form (W.N.W.)



Take it from the top, Mac..

Stand this new Telefunken model 204E on its head — and that's about the only time you're in trouble. Otherwise, you can build it into that avant-garde 'entertainment shelf' standing up-ways, sideways or front-end, because every control and socket is on the deck. The other attributes of a great tape-recorder — it's got those, too. Separate and individual volume, tone and record-level controls. Track selector, multi and synchro-play on the one easy dial. Two speeds, 7½ and 3¾ — at 7½, your response is 40-18,000 C.P.S. Output? That's big — 12 watt push-pull, fully transistorised, push button operation.

We could get a whole lot more technical — but then we guess you'd rather hear it on our fantastic — and we do mean fantastic — demonstration tape that fully explains and pinpoints every remarkable feature of the M204E. (You like it — it's yours, dubbed on the free tape that goes with every recorder. In fact, this demonstration tape no sound enthusiast should miss hearing — it's a rare entertainment piece in itself.)

One final thing — bring her along when you come to look. She'll tell you this Telefunken M204E model is just beautiful. And for once, she's right — that Scandinavian oiled cabinet with satin-finish metal top deck looks pretty good. Price **$490** (£245)

TELEFUNKE

AUSTRALIAN DISTRIBUTORS:

W. C. WEDDERSPOON PTY. LTD.
193 Clarence Street, Sydney, N.S.W. Phone: 29-6681

ADELAIDE: K. W. Mayer & Co., Evans Bldg., James Place. Phone: 51-4546. PERTH: Musgroves Ltd., 223 Murray St. Phone: 21-6611. MELBOURNE: Refer Sydney. BRISBANE: Sydney G. Hughes, 154-158 Arthur St., New Farm. Phone: 58-1014.

rade In Brief — cont.

A QUARTZ CRYSTAL FILTER, made
Western Germany and under the brand
K.V.G. is now becoming available. The
er is centred nominally on 9MHz and
o types are made, XF-9A with four
stals and XF-9B with six crystals. As
y well be imagined, the performance of
latter unit is superior, but the 4-crystal
it has characteristics which will suit most
quirements.

The complete filter comes in a surprisingly
all metal case which measures approxi-
ately 1-3/8in x 1-1/16 x ¾in. Fixing to
chassis or panel is by two screws, with
extra holes, one each for the input
l output terminals. Terminations are un-
anced.

These filters are intended for use in
B transmitters and receivers and each
er unit is supplied complete with two
tching carrier crystals, one for each side

QUARZFILTER
XF-9A
KVG

he passband. The crystals are mounted
ub-minature type HC-25/U holders. Two
ets are also supplied for the crystals.

ggested circuits are given by the manu-
rers and the crystal oscillator circuit
ested makes provision for trimming the
al frequency of oscillation over a range
500Hz. This allows the carrier to be
ioned at the correct point on the skirt
e passband.

e have not had the opportunity to make
measurements on the filter units. How-
the makers quote that the passband
mmetrical and to give some idea of the
rmance, we quote the makers' figures
oth types:

r	XF-9A	XF-9B
lwidth (-6dB)	2.5KHz	2.4KHz
le (max.) tion	1dB	2dB
loss (max.)	3dB	4dB
e factor	6:50dB 1:1.7	6:60db 1:1.9 6:80dB 1:2.2
l stop (min.)	45dB	80dB
inal R	500 ohms	620 ohms
inal C	30pF	30pF

e Australian distributors are Messrs
in Wynne Pty. Ltd., 32 Falcon Street,
's Nest, N.S.W. Limited stocks of the
XF-9A are now available at $36.00
ding tax), complete with matching
ls. Type XF-9B is available to order
(I.L.P.)

IRCHILD AUSTRALIA PTY. LTD.,
w manufacturing zener diodes in its
y at 420 Mt. Dandenong Road, Croy-
Victoria, and claims these are the first
made in Australia. The company says
AN7101/2/3/4/5 and 6 series of
zener diodes being made locally use
atented Fairchild "Planar" process to
e a stable reference voltage with low
nic resistance, low leakage, low capaci-
and high reliability. A feature of
zeners is their low price, which can be
as 35c.

ther information and technical data
ainable on request from the marketing
es department, Fairchild Australia Pty.
at the address shown above.

KAS INSTRUMENTS AUSTRALIA
Oldham Road, Elizabeth, S.A., now
available digital integrated circuits
930-series configuration in a moulded
package. The complete family of 11 DTL circuits is available in the moulded package, including dual, triple and quadruple gates, buffers, expanders, binary elements and one-shot. Those designed for operation in the industrial temperature range (0-75 degrees C) have been designated Series 15830N.

The transfer-moulded plastic package features 14 plug-in pins on 100-mil centres, for flow-soldering and wire-trap technique. Distance between rows of pins is 300 mils. The package meets or exceeds MIL STD 202C, method 106B for moisture protection.

FERRIS BROS. PTY. LTD., announce that their portable car radio has been selected by the Industrial Design Council of Australia for display at the EXPO'67 exhibition to be held in Montreal next year. It will be one of nine design index products to appear in the Australian Pavilion, selected to represent Australian capabilities in the design field.

NEW 20,000 OPV MULTIMETER

University Graham Instruments Pty. Ltd. have recently released a new portable multimeter ideally suited to the serviceman and hobbyist. Conveniently small, the instrument nevertheless has a large enough scale and sufficient ranges to enable the user to obtain quite accurate readings.

VOLTS & AMPERES
OUT

The multimeter is manufactured in Japan, the ranges and general layout being the result of co-operation between University Graham and the manufacturers. Since University Graham has had many years of experience in the manufacture of meter movements, they are in a position to give effective after-sales service for the imported instruments. Their confidence in the product is evident from the use of the trade mark "University" on the meter face.

The new multimeter is well designed mechanically, consisting of a heavy plastic moulding with black lacquered metal back cover. All the components are mounted with easy access on the plastic moulding, two notable items being the heavy-duty range-switch and the substantial ohms-adjust potentiometer. The method of mounting the meter movement precludes any chance of its being damaged by possible leakage from the batteries.

On the front panel, all lettering is engraved and filled with white lining, thus providing a long-lasting finish. All ranges are switched and it is not necessary to rely on jack-type switches, as utilised in some of the cheaper meters.

The ranges, listed below, have been selected with care to give the maximum versatility possible with reasonable overlap. The extra jack marked "out" is coupled to the positive jack with a .05uF 600VW capacitor and may be used for audio output monitoring during receiver alignment etc. The ranges available are as follows: DC volts: 2.5 - 10 - 50 - 250 - 1,000; AC volts: 2.5 - 10 - 50 - 250 - 1,000; direct current: 50uA - 2.5 mA - 25mA - 250mA; Ohms (full scale): 10K - 100K - 1M - 10M; dB: minus 20 to plus 22 and plus 20 to plus 36.

Using a 50uA movement, sensitivity as a voltmeter is 20,000 ohms per volt on the DC ranges and 8,000 ohms per volt on the AC ranges. A small instruction leaflet supplied with the multimeter states the reading accuracy as 3 per cent for DC ranges and 4 per cent for AC ranges. All ranges were checked on the sample and found to be well within the tolerances claimed. University Graham state that sampling tests on many units indicate an average accuracy of about 2 per cent.

When the sample which we tested was forwarded, we were invited not only to check normal performance of the instrument but to submit it to the kind of overload that could be expected with an inexperienced handler. The company representative went on to say that no objection would be raised if the meter was damaged during such overload tests. Reason for the suggestion was that the multimeter has a built-in diode protection system consisting of two diodes wired in parallel and reverse sign across the meter movement.

The treatment described hereunder is certainly not recommended for ordinary multimeters and, even when a protection device is fitted, one hates deliberately to overload such an instrument. As a first step we applied double, and then treble, full-scale voltages on both the AC and DC ranges; no distress was indicated by the meter. The ratios were then increased until, at 15 times full-scale readings AC and DC we called a halt. At no time did the meter even look like being damaged, either electrically or mechanically.

Then, getting really savage with the multimeter, we applied the prods to a 250-volt source while switched to the various ohm ranges; again the multimeter survived the treatment. During each test, the prods were removed immediately after the meter needle hit the stop, as would be expected from a normal person realising that the meter was reading off-scale.

Overload tests were then conducted on the current ranges, ending with a current of over 50mA being passed through the 50uA range. Still the multimeter was not damaged in any way.

As a kind of "king hit," we then tried applying first 6.3VAC, then 240VAC to the 50uA range. The 6.3VAC caused no distress but the final test of 240VAC to the 50uA range caused the demise of two wire-wound resistors. But, even after such brutal treatment, the meter movement itself still seemed to be in perfect condition.

After this test-to-destruction routine, we can only say that the performance was extremely impressive and we would not hesitate to endorse the built-in protection system as almost foolproof.

The University Model MBA4 multimeter is available through all wholesale and retail outlets and the retail price including tax is $16.31. If so desired the multimeter may be obtained direct from University Graham Instruments Pty. Ltd., 106 Belmore Road, Riverwood, N.S.W. In this case it would be necessary to add an additional $1 to the above price for packing and freight. (K.W.)

LAFAYETTE Announce a Further Release of Australia's Greatest Hi-Fi Stereo Amplifier Bargain

LAFAYETTE 70-WATT STEREO AMPLIFIER MODEL LA-350

- Six Pairs of Stereo Inputs for all Sources.
- Handsome Extruded Aluminium Front Panel.
- DC on Preamp Filaments for Minimum hum.
- Tape Monitor Switch.
- Stereo Headphone Jack on front Panel.
- Separate Channel Tone Controls.

The deluxe Lafayette LA-350 is packed with power, features and handsome styling. 70 watts of sonic power produces tonal beauty to match its good looks. Delivers plenty of reserve power to drive even inefficient speakers to full listening levels. Eleven comprehensive front panel controls provide utmost flexibility—assures "custom" sound reproduction in your home. Six position program selector enables instant selection of music sources including tape head inputs for direct playback of tapes from a stereo tape recorder. Mode switch provides choice of left or right channels, mix, stereo and reverse channels. Separate bass and treble controls are frictioned-locked and are adjustable independently or simultaneously. Friction-locked balance controls adjust each stereo channel for perfect separation. Separate volume control and power switch makes possible undisturbed control settings — simplicity of operation. Also features: tape monitor switch which lets you listen to tapes while recording, rumble filter, loudness switch and a convenient front panel stereo headphone jack with a switch to silence speakers for real private listening. Rugged construction and quality components will provide years of dependable performance.
DC on preamplifier filaments and hum adjust controls on both DC and AC filament lines minimises hum to extremely low levels. Two AC convenience outlets on rear panel apron permit simple connection of tuner and phono AC line. Handsome brushed gold extruded aluminium front panel and knobs with contrasting case fits in any decor. 14 5/8Wx5 1/4Hx10"D. For 240v 50 cycles AC.

SPECIFICATIONS

Power Output: 70 watts Music Power: 28 watts per channel continuous. **Frequency Response**±1 db 15 to 30,000 cps at normal listening level. **Harmonic Distortion:** Less than 1 per cent. **Hum and Noise:** 55 db down on Phono inputs, 76 db down on auxiliary inputs. **Channel Separation** 50 db at 1KC. **Inputs and Sensitivity.** Tape Head and Phono 1,1.5 mv; Phono 2, 6 mv; Tuner, 200 mv; Auxiliary 1, 10 mv; Aux. 2, 750 mv. **Output Impedances:** 8 and 16 ohms. **Tape Outputs:** 2 pair. **Tubes.** (3) 12AX7/ECC83, (2) 6AN0, (4) 7198A; 5 diodes. 2 AC Outlets, 1 switched.

USUAL PRICE £99/15/-. SPECIAL OFFER £69/15/-, $139.50.
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51-6362

Trade In Brief — cont

EMERSON AND CUMING, INC., Canton, Massachusetts, U.S.A., has sent i formation on the following new product Eccofloat PG30. This is a syntactic foa system designed for casting or void fillin When cured, it has a density of 30lb p cubic foot and a compressive strength in e cess of 2200psi. It is supplied as a thre element kit. Element A is composed of h low epoxy spheres 3/16 to 7/16 diamete Element B is a room temperature curi epoxy used to put a thin coating of res round the spheres. Element C is a l density resin system containing glass micr spheres used to infiltrate the resulting stru ture. Initial cure requires about 24 hou with ultimate properties developing with seven days.

Eccobond 286 is a two-part room temp ature curing epoxy adhesive which conta no solvent and is 100 per cent reactive. T two materials are supplied in collapsi tubes, and are prepared by mixing eq quantities of each. Contact pressure is n mally sufficient for fixing, and curing complete in about 24 hours, although t can be speeded up by the application heat. The adhesive can be used for joini aluminium, steel and other metals, PV, neoprene, cellulose acetate and many ot materials.

Eccosorb HT-98 and HT-99. These microwave absorbers which the makers are capable of operating in the temperat range of -70 degrees F to plus 700 degr F. They are made entirely of non-co bustible materials and can operate un much higher power loads than foamed p tic absorbers. HT-98, in blocks 12 x 1 2in, gives maximum power reflection fr S-band to K-band. HT-99 is supplied blocks 12 x 18 x 3in and gives 2 per c reflection from L-band to K-band.

Stycast 2050 is a two-part epoxy r casting resin with handling characteris which make it suitable for volume proc tion. It has low viscosity and long pot and can be cured in three hours at 140- degrees F, or within two to three days room temperature.

Eccobond 285 is a two-part room temp ture curing adhesive available in a uni partitioned Xacto Cup with the two p properly proportioned. It is said to be i for jobs requiring small amounts of sive. To prepare the material for use plastic film cover on the packag stripped off and the centre of the cont is pushed down. This removes the par between the two parts and forms a spherical cup in which the two element mixed. One part is black and the white to determine when mixing is com

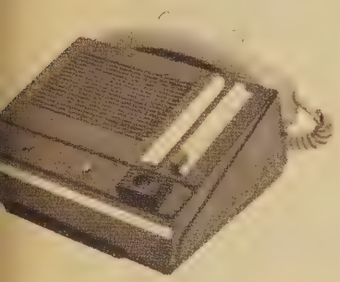
Eccobond 285 in Xacto Cu Material is supplied with the t parts correctly proportioned f mixing. One part is black and t other white to assist mixing.

Stycast 2762 is a two-part potting encapsulating epoxy system designed high temperature use. Its thermal con with retention of electrical insula- qualities is said to be well above rage.

urther details of these products can be ained from the Australian agents, Wm. McLelland Co. Pty. Ltd., The Crescent, gsgrove, N.S.W.

ORNING GLASS WORKS points that the heading "GLASS ENCAPSU- TED TIN OXIDE RESISTORS" over a s item in our November issue, page concerning the range of glass tin oxide tors the company now stocks, is mis- ing. They advise that the term "glass" rs to the substrate material used in the tors, and that they are not glass encap- ted.

HILIPS ELECTRICAL PTY. LTD. has ased details of a new system for internal munications known as MULTICOM. ures of the system are: Any number tations can be connected in a system each station can select 29 others; talk its are unrestricted as each station has own amplifier—there is no limit to the ber of simultaneous independent two- conversations; a central power supply ides safe low voltage power (24V DC) each station fed through the inter- ecting cables; operation is simple, con-



on being established by push buttons, communication is either by direct voice speaking) or through optional tele- e handsets which can be fitted to all .

presence filter fitted to each station ts frequencies around 3KHz and attenu- low frequencies, to give natural voice duction with high intelligibility, and ving volume is adjustable at each sta- to suit the environment. The standard m incorporates a "not available" ity on all stations, while personal lines, te conference and multiple lines are able without modifications.

ch station has a built-in directory fitted into the base of the unit, in h identification numbers and names of ations are displayed.

e Multicom is being manufactured in ps' new production centre at Brook- near Sydney. Inquiries should be sent he company's head office at 69-79 nce Street, Sydney, or branch offices her States.

ALGAMATED WIRELESS VALVE PANY PTY. LTD. is inviting inquiries uotations for a new range of memory s with moulded plastic frames. The any says the units have been ically designed to cut the cost of ry stacks for the commercial market hat the new rugged high-impact plastic s meet many MIL specification rements.

V.V. lists the following features of the levices:

gged construction. Individual plane s are moulded of tough, rigid high- t plastic. Wiring terminals are moulded he material and jig-soldered for maxi- uniformity from plane to plane.

npact design. The new design es reduce space between cores, reduce between planes, shorten wiring to re- length of current paths, and also ate complex printed-circuit input/out- nnections.

Three basic plane sizes. Planes are available with 4096 cores (64 x 64), with 8192 cores (64 x 128) or with 16,384 cores (128 x 128) . . . with diagonal or rectangular senseline wiring.

High-operating speeds. For 1usec memories . . . with high-speed RCA 20- or 30-mil coincident-current ferrite cores.

Adaptable to special packaging. Densities to 12,000 bits per cu. in. have been attained.

Further details are available from the AWV head office at 348 Victoria Road, Rydalmere, New South Wales.

AUSTRALIAN GENERAL ELECTRIC PTY. LTD., 103 York Street, Sydney, has sent information on the General Electric 14A502 Light Detector, which is an NPN Planar silicon phototransistor, packaged in a hermatically sealed can and provided with a focusing lens at the top of the can.

Brief technical data are: Maximum voltages, collector to emitter and collector to base 45V; emitter to collector and emitter to base 5V; light current 50mA. Switching characteristics, delay time 2uSec. rise time 5uSec—storage time 0.5uSec. — fall time 5uSec.

For most applications two leads are used (collector and emitter leads) but a third is provided (base lead) which controls sensitivity and the gain of the device.

FERRANTI LTD., of Gem Mill, Chadderton, Oldham, Lancs. U.K., has produced two new parametric amplifiers.

The VCA/C12 is a low noise non-degenerate parametric amplifier operating in the frequency range 4.0 to 5.0GHz. The balanced idler circuit employ two Ferranti variable capacitance diodes which are mounted in a single encapsulation and operate in push-pull at 13 GHz. The use of this configuration eliminates filters in the idler circuit.

The combined noise figure for the amplifier and ferrite circulator is less than 2.3dB and for a gain of 20dB, the 3dB bandwidth is a maximum of 40MHz.

Type VCA/L10D has been designed for radio astronomy applications in the frequency range 400 to 1,000MHz, and is a degenerate parametric amplifier which is supplied complete with a crystal controlled solid state source. By varying the DC voltage applied to the source, the pump input power can be controlled, thus providing a means for remotely controlling the amplifier gain.

The excess noise temperature is 50°K and for a gain of 20dB at 600MHz, the 3dB bandwidth is 6MHz.

R. H. CUNNINGHAM PTY. LTD., 8 Bronham Place, Richmond, Victoria, has available a range of Geloso transistorised intercommunication telephone systems as "Do-It-Yourself" kits.

A leaflet describing the kits available, and prices, can be had on application to the company's head office at the address given above, or State branches in Sydney, Perth and Brisbane.

PETER SHALLEY, has now opened a showroom in the heart of Sydney's busy shopping centre, for the sale of walkie-talkies, high fidelity audio equipment, tape recorders and amateur radio equipment. The new showroom is situated at 95 York Street, just behind the Nock and Kirby store.

Mr Shalley advises that he will stock most of the usual big names in the high fidelity field, such as Akai, Sharp, National Fisher, Elac, Star, Nikko, Tokai, Dual, and Sanyo.

He will also carry the range of Telecon transceivers up to the 5-watt unit, and some more specialised items, such as a new 300-watt portable generator made by Honda, of Japan, for driving mains operated equipment at outdoor locations not supplied with mains power.

CLASSIC TAPE RECORDERS

MAGNETIC TAPE DIRECT
from U.S.A.

GUARANTEED QUALITY
Money back if not satisfied.

LOWEST PRICED
tape in Australia.

ALL POLYESTER BASE
Except 7in 1200ft which is available in both. Acetate and Polyester.

	$
7in 1200ft Polyester	2.25
7in 1200ft Acetate	2.00
7in 1800ft Polyester	3.50
7in 2400ft Polyester	5.00
5¾in 1200ft Polyester	3.30
5¾in 1800ft Polyester	3.90
5in 600ft Polyester	1.60
5in 900ft Polyester	2.00
5in 1200ft Polyester	2.80
3¾in 600 Polyester	1.80
3in 150ft Polyester	.56
3in 225ft Polyester	.60
3in 300ft Polyester	.96
2½in 300ft Polyester	.96
7in Empty spool, boxed .	.75
5in Empty spool, boxed .	.55
3in Empty spool, boxed ..	.25

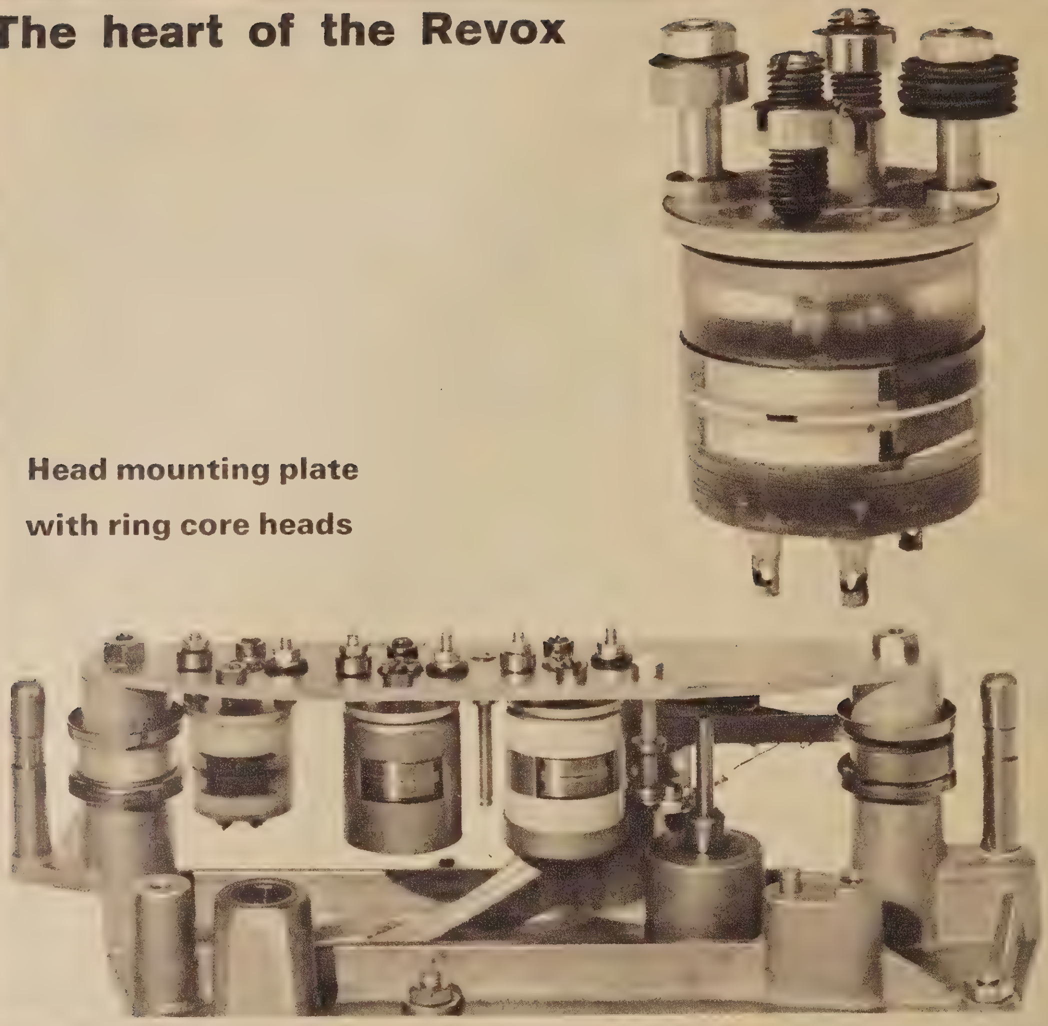
Leader tape 1 cent per foot

SPECIAL OFFER
When buying 10 reels of 7in or 5in tape you will receive one 3in
FREQUENCY TEST TAPE FREE
40-14000 cps. for tape head alignment and frequency response test.

SPECIAL DISCOUNT
10 per cent reduction when buying 5 reels or over of any mixed size. Postage, packing N.S.W. 50 cents, other States 80c.

CLASSIC TAPE RECORDERS
93B LIVERPOOL ROAD,
SUMMER HILL, N.S.W.
Telephone 79-2618

The heart of the Revox



Head mounting plate with ring core heads

N.A.B. Spool centres are now available for the REVOX.

One of the first and most important inventions, which helped to advance the art of magnetic recording, was the ring core head. It is virtually uneffected by external stray-fields. A complicated manufacturing process is involved in making these heads and for this reason a simplified form is most often found in amateur tape recorders. In the REVOX series we find only genuine ring core heads. The heads are mounted on the head plate in the following sequence: Erase-head, Record-head and Playback-head. Two versions for either 2-track or 4-track operation are available.

REVO

HAVE
A LIFETIME'S
EXPERIENCE
IN
TAPE RECORD

SOLD AND SERVICED BY AMALGAMATED WIRELESS (AUSTRALASIA) LIM

SYDNEY 2 0233. MELBOURNE 67 9161. BRISBANE 4 1631. ADELAIDE 51 0111. PERTH 28 3426. LAUNCESTON 2 1804. WELLINGTON, N.

Australis I Satellite Nearing Completion

The first Australian artificial earth satellite built to carry amateur radio equipment is now expected to be launched in the early part of 1967.

By Pierce Healy, VK2APQ*

Some problems that developed in the tele-etry system in the flight model of the 45.050MHz telemetry transmitter for the ustralian amateur satellite Australis have ow been overcome and it is expected at the delivery of the satellite, to the scar Project headquarters, in California, ill be made in January, 1967.

The AUSTRALIS project is a joint ven-re of the Melbourne University Astro-autical Society and the Wireless Institute f Australia.

Following a request from the Project scar Group the VK-keyer has been hanged to a HI-keyer. This is in line ith the Oscar policy that Amateur Radio atellites should not identify themselves with ny national group, but should be repre-entative of radio amateurs throughout the orld.

There will be two or three "HIs" transmit-ed by AUSTRALIS during every 10-second dentification period.

Owen Mace, who is in charge of the rbital computations for project AUS-TRALIS has suplied the following informa-ion concerning orbital predictions for the atellite.

When AUSTRALIS is launched, tracking tations will have to know when and where hey can expect to find the satellite. Hence rbital predictions are required for stations round the globe.

Since the generation of these predictions s only a means to an end, and not of ntrinsic interest in itself, we decided to upply antenna pointing figures such as hose illustrated in figure 1.

These figures apply to NIMBUS 2, a United States weather satellite which trans-mits pictures of cloud cover back to earth. This satellite is tracked regularly at the university, and these calculations have been made by the university's IBM 7044 com-puter.

Unfortunately, to supply these figures to every station in the world, we would re-quire vast quantities of paper and computer time. Therefore the generation of orbital predictions has been divided into two sec-tions, each with a separate computer pro-gram.

The first program is called APTSAT and is illustrated in figure 1., which will be supplied to all command stations and to each State co-ordinator. The co-ordinator will then distribute the data to individual stations by means most suited to his location, e.g. VHF links or by post. Samples of APTSAT have already been sent to the State co-ordinators.

Some several weeks before the launch, copies of the predictions will be mailed to co-ordinators. The data will be based on the best prelaunch orbit prediction available, and should yield workable results for at least a few days after the launch.

As soon as the launch has been verified, postlaunch figures will be generated and these will be mailed to co-ordinators for dissemination. Predictions will be generated at regular intervals for up to a month ahead.

Thus an amateur wishing to track AUSTRALIS will receive the antenna pointing figures from his State co-ordinator who has the responsibility of distributing predictions and also receiving and forwarding Project Australis, signal reports and decoded data. A list of the State co-ordinators is given on page 163.

The second program, SEG, will produce figures enabling co-ordinators around the world to produce antenna-pointing figures for their own areas. The advantage of this program is that it requires far less computer time, about one tenth of the time and one tenth paper, and each set of figures is applicable over a wide area. The figures for the antenna are obtained graphically and so is much quicker than other arithmetic methods. It is used by stations around the world for the NIMBUS and ESSA satellites.

Distribution of this SEG information will be made on a world-wide basis and will be similar to the APTSAT distribution, except that there will be supplemental radio and RTTY broadcasts.

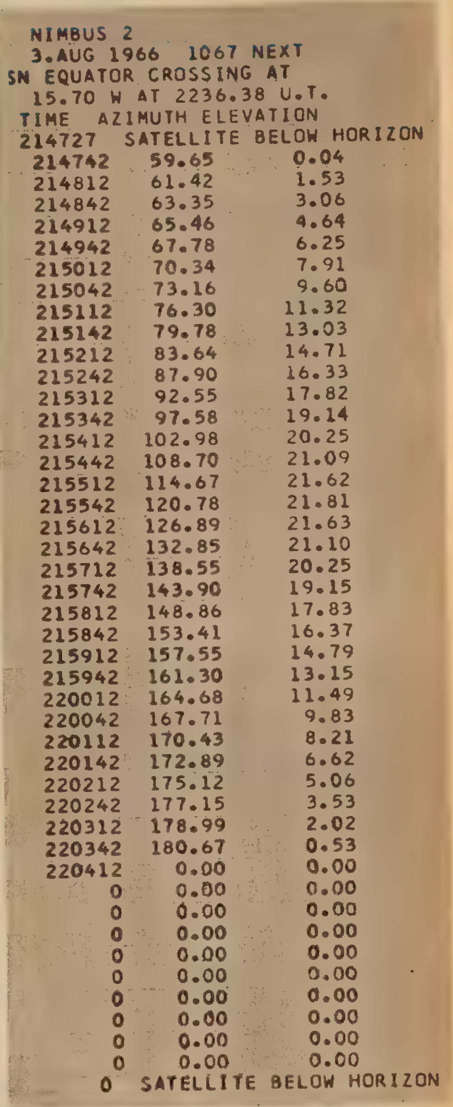
It is perhaps interesting to note that the computer took about ¼sec. to calculate the data shown in figure 1 and about 2¼ sec. to print it. Each figure is the result of long and tedious spherical geometry equations. It is estimated that it would take several hours to complete the data given in figure 1 manually — not to say anything of the accuracy.

It should be noted that, strictly, the APTSAT data (fig.1) apply only to one location, so that errors are incurred if the figures are used for any other location. However, since the beam width of most antennas (between half-power points) is large, error may be negligible.

The maximum error in the data, E°, is approximately given by:

$$E \cong \frac{180}{500 \quad \pi} \times X = 0.115X$$

where X miles is the distance of the station from the point for which the figures have been calculated, assuming a 500-mile orbit.



```
  NIMBUS 2
   3.AUG 1966   1067 NEXT
SN EQUATOR CROSSING AT
   15.70 W AT 2236.38 U.T.
 TIME   AZIMUTH ELEVATION
 214727   SATELLITE BELOW HORIZON
 214742     59.65          0.04
 214812     61.42          1.53
 214842     63.35          3.06
 214912     65.46          4.64
 214942     67.78          6.25
 215012     70.34          7.91
 215042     73.16          9.60
 215112     76.30         11.32
 215142     79.78         13.03
 215212     83.64         14.71
 215242     87.90         16.33
 215312     92.55         17.82
 215342     97.58         19.14
 215412    102.98         20.25
 215442    108.70         21.09
 215512    114.67         21.62
 215542    120.78         21.81
 215612    126.89         21.63
 215642    132.85         21.10
 215712    138.55         20.25
 215742    143.90         19.15
 215812    148.86         17.83
 215842    153.41         16.37
 215912    157.55         14.79
 215942    161.30         13.15
 220012    164.68         11.49
 220042    167.71          9.83
 220112    170.43          8.21
 220142    172.89          6.62
 220212    175.12          5.06
 220242    177.15          3.53
 220312    178.99          2.02
 220342    180.67          0.53
 220412      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0      0.00          0.00
      0   SATELLITE BELOW HORIZON
```

Figure 1. Antenna pointing figures for receiving signals from the NIMBUS 2 weather satellite, provided by the Melbourne University's IBM 7044 computer.

If this error is the same as beam width of the antenna, B, between 3dB points, then the computer data are accurate enough for any station within the circle of radius X miles where

$$X = \frac{B}{2} \div 0.115 = 4.3B$$

E.g., a six-element Yagi antenna has a beam width of approximately 60 degrees.

Therefore the computer data are accurate for this antenna located anywhere in the circle of radius

X = 60 x 4.3 = 260 miles.

For a station outside this circle, SEG figures must be used to find the antenna

---

***News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.**

TELECON TRANSCEIVERS

• MOST RUGGED • MOST POWER • MOST RANGE

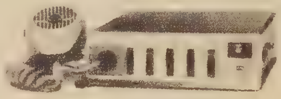
Approved by P.M.G., Bush Fire Committee, Mines Dept.

1 watt model 214

Two channels, noise limiter, battery meter, squelch control, rugged zinc alloy ribbed case, used exclusively by security police during visit of President Johnson, range is greatest of all 1 watt transceivers, complete with all plugs, etc.

$107.30 plus tax ($13.40).

2 watt model 704

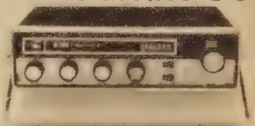


Complete with dash bracket for vehicle mount, 2 channels, noise limiter, squelch, 2 function meter, dynamic mike with press to talk, with all plugs, sockets, power cable. — Price **$126.00** plus tax (**$15.75**).

Look who use them:

POLICE DEPT. N.S.W.
POLICE DEPT. TASMANIA
POLICE DEPT. (C'WEALTH)
DEPT. MAIN ROADS
ROYAL AUST. NAVY
COM. DEPT. OF WORKS
SHELL OIL CO.
BRITISH PETROLEUM
FORESTRY COMMISSION
P.M.G., N.S.W., VICTORIA
OVERSEAS TELECOMMUNICATIONS COMM.
WATER BOARD
C.S.I.R.O.
ELDER SMITH-GOLDSBROUGH MORT
WINCHCOMBE CARSON
DALGETY-N.Z. LOAN
LEND LEASE DEVELOPMENT
T. C. WHITTLE
MONIER (CONCRETE) INDUSTRIES
DEPT. CIVIL AVIATION
MINNESOTA MINING (3M)
I.C.I.A.N.Z.
TOWNSVILLE ELECTRICITY BOARD
NORTHERN ELECTRIC AUTHORITY
FULL LIST OF OTHERS ON REQUEST

5 watt model 703



10 channels, operates from car or power mains, highest powered transmitter on the market, special noise limiter and squelch for noisy areas, special receiver can tune all C.B. frequencies, complete with all power cables, mike, etc. Price **$190.00** plus tax (**$23.75**).

.1 watt model 204

Big unit performance in mini-case, battery meter, weighs only 12 ozs. with battery, fits shirt pocket, zinc alloy ribbed housing, range up to 6 miles (letters from users available on request).

Price **$50.00** plus tax (**$6.25**).

AND:

C.C. TELEVISION CAMERAS, MONITORS, V.H.F. TRANSCEIVERS, DIGITAL FREQUENCY COUNTERS, MOSLEY ANTENNAE, STEREO TAPE PLAYERS, NI-CAD RECHARGEABLE BATTERIES FOR ALL TELECON UNITS, WITH CHARGERS. ALL EQUIPMENT CARRIES SIX MONTH WARRANTY AGAINST FAULTY PARTS OR WORKMANSHIP, **PLUS** A GUARANTEE TO SUPPLY PARTS AND SERVICE FOR **FIVE YEARS** FROM DATE OF SALE.

Sole Australasian Agents:

STRATO COMMUNICATIONS PTY. LTD.
25 WENTWORTH STREET, PARRAMATTA, N.S.W.
TELEPHONE: 635-9856—CABLES: STRATOCOM, SYDNEY.

inting data. Instructions for the use of :G will be included in the "Mission)erations Plan" to be sent to all state -ordinators about one month prior to the ınching date.

The co-ordinators in each of the Austra-n states are:—

New South Wales: Alex Swinton, VK-AK, Box 1, P.O., Kulnura, Phone: ılnura 261.

Victoria: Bill Rice, VK3ABP, 54 Maid-)ne Street, Altona, Melbourne. Phone: -8549.

Queensland: Lawrie Blagbrough, VK4-GL, 54 Bishop Street, St. Lucia, Brisbane. ıone 7-3198.

South Australia: Brian Tideman, VK5TN, Ningana Avenue, Kings Park, Adelaide. ıone: 71-8144.

West Australia: Don Graham, VK6HK, Purdom Road, Wembley Downs, Perth. ıone: 26-2864.

Tasmania: Peter Frith, VK7PF, 181 ınchbowl Road, Launceston. Phone: 1345.

Project Australis adress is:—

Project Australis, Melbourne University stronautical Society, Union House, Park-lle, N2. Victoria. Phone (office hours): -0484, Ext. 843.

MORE COMMENTS FROM W2NSD

Last month we gave a transcript of a scussion with Wayne Green, W2NSD, litor of "73" magazine, in relation to T.U. matters.

In discussing the subject of Novice Lic-ıces, Wayne had this to say.

"Let me give you a little background on ›vice licensing in the United States. The ›vice licence was brought in about a tle over 10 years ago by the Federal ommunications Commission (F.C.C.), our censing authority.

"The A.R.R.L. fought the novice licen-ng bitterly and tried everything they could stop it — they did not want cheap cences, as they put it. The F.C.C. look-g at the long picture saw that the number radio amateurs in the U.S.A. was ropping and felt that something must be one to change the pattern for the good the country."

VK2APQ: "That was the F.C.C. view?"

Wayne: "Yes, it was the F.C.C. view, they introduced the novice licences gainst the bitter opposition of the A.R.R.L.

"The novice licence has been extraordin-ily successful. It changed the swing and ıstead of dropping off the licences rose a faster rate than we have ever had in ıe country, and our licences went from bout 120,000 to 250,000 in a few short ears.

"We have no complaint about the novice cence. It does its job and is a very mple thing to get. A person with just bout a week's study can pass the licence xam for a novice and get his introduc-on, get his feet wet with amateur radio. le is allowed to go on the air with 5-watts crystal-control CW on 80, 40 and 5 metres. He can get on the air and work X and he can even get on two-metre hone, so the licence has been extremely ıccessful with us."

VK2APQ: "How about as far as the lectronics industry is concerned. Are they ro novice licences as a training ground?"

Wayne: "Yes, definitely."

VK2APQ: "And would you say it has ontributed quite a deal to the industry?"

Wayne: "Yes, obviously, for we have uite a number of transmitters and even ceivers being manufactured for novices nd they certainly have been very success-ıl.

"The novice had a lot to do with the ıccess of our Gon-set communicator, one the most successful pieces of equipment ver built. I have forgotten how many ıousands they sold, but it was in the ens of thousands."

VK2APQ: "You are mentioning now the ommercial market and the sale of equip-ıent. I was thinking of the technicians who received their initial training through ovice licensing and found their way into ıdustry."

Wayne: "Well of course I don't know what the manufacturers' reaction is to that. I know that roughly 50 per cent of our amateurs in the U.S.A. are in the electronics industry and since the great bulk, I would say all, of the amateurs in the last 10 years or so have come in through the novice program, obviously it has been a very great benefit there."

VK2APQ: "Do you find that there is a general tendency for the novice to go for his higher ticket?"

Wayne: "I believe so. I do not have the percentages right at hand, but I believe close to 40 per cent to 50 per cent of the novices become general licensees, which is quite satisfactory."

VK2APQ: "What about the formation of clubs like our Youth Radio Scheme. Are they fostered to any extent?"

Wayne: "Radio clubs are extremely valuable for the help of people interested in amateur radio and, certainly the most valuable thing is to have radio clubs in your High Schools and in your universities. Particularly in the High Schools, because this is where the fellows are at the age when we normally get interested in amateur radio and want to learn more about it. We want to get together with fellows that know about it, to ask questions and exchange enthusiasms and the High School Radio Club is the ideal ground for this.

"I think that one of the things we want to encourage in the African and Asian countries is the introduction of Amateur Radio Clubs into their High Schools. and one of the things I am going to try to do is to get equipment to send into these countries to help to form these clubs and give them club stations."

Wayne went on to tell of discussions he had with various Government officials in the countries he has visited and the interest they had shown in the formation of amateur radio clubs and the hopes he had for the success of such projects.

Season's Greetings

to all readers of these notes

To those who have written expressing their interest in various aspects of amateur radio and those who have sent in notes on local events and other items of interest, a very sincere thank you.

Look forward to hearing from you again in 1967.

73'
VK2APQ

WIRELESS INSTITUTE ACTIVITIES

Air Commodore A. G. Pither (Retired) has accepted the appointment as I.T.U. Representative for the W.I.A.

This follows a meeting held earlier this year with Mr George Pither and members of the W.I.A. Federal Executive when all aspects of amateur service representation were discussed.

George Pither is fully qualified for this task and his past experience in matters relating to radio communication will be great value to the Institute and the amateur service generally. A full biography was given in the "Proceedings of I.R.E.E. Australia" for June, 1966, Volume 27, No. 6, Page A26.

He was one of the first R.A.A.F. graduates from Duntroon in 1930, and after becoming a pilot in 1937 spent some time at Cranwell. In 1940, he was Staff Officer for Signals Training and after attending the R.A.F. Radar Course established a Radar School.

He was in the United Kingdom on exchange in 1943 and was at Training Headquarters for the operation "Overlord." He visited Japan in 1946 as a member of the Australian Scientific Mission and from 1951 to 1954 was Superintendent of the Woomera Rocket Range. From 1954 to 1959 he was Director of Telecommunications, R.A.A.F. Headquarters. Before commanding the R.A.A.F. at Laverton he was Staff Officer Telecommunication Engineers, R.A.A.F. Support Command.

He has been chairman of the I.R.E.E. Australia, Melbourne Division, and chairman of the I.E.E. and is currently chairman of the Royal Flying Doctor Service Radio Committee. More recently he has taken out the amateur call sign VK3VX and has also been elected to council of the I.R.E.E. His full title is Air Commodore A. G. Pither, C.B.E., F.I.R.E.E. (Aust.), M.I.E.E., M.I.E. (Aust.), R.A.A.F. Retired.

REGION III MEETING

Following his return from a trip to Japan, Alan Elliot, VK3AL, reported to Federal Executive that both the Hong Kong Amateur Radio Transmitting Society and the Japan Amateur Radio League were most interested in a possible meeting of Region III Societies.

NEW SOUTH WALES

A very large gathering of members at the October meeting of the New South Wales Division heard a most informative and interesting lecture entitled "Television Techniques."

The lecturer, Sid Molen, VK2SG, did an excellent job in covering such a wide field in a limited time. Sid who is on the staff of Channel 10 in Sydney dealt in the main with the equipment installed at that station.

In pointing out that the television system may be divided into two sections, optical and electronic, Sid proceeded to deal with the various aspects that must be considered to first produce an acceptable picture to the viewer.

Lighting was the first technique discussed, then the types of lenses used in a television camera. This was followed by a description of the Image Orthicon and Vidicon picture tubes and associated amplifiers, making particular reference to the types of multivibrators used.

By far the most complex piece of equipment described was the video tape recorder; three Ampex 2000 units are installed at Channel 10. The lecture was illustrated by the use of numerous colour slides and from the interest shown will no doubt be the forerunner of several more lectures on specific equipment used.

Prior to the lecture, Mrs M. Peel widow

GET YOUR
HAM LICENCE

Classes for the year 1967 will start on 14th February, 1967, to cover all phases of the Ham Licence.

Correspondence Courses are available through the year.

All inquiries to the Course Supervisor,
W.I.A. 14 Atcheson St.,
Crows Nest, N.S.W.

ELECTRONIC DEVELOPMENTS PTY. LTD.

KITSETS - - BUILD IT YOURSELF SAVE $$$s

AMPLIFIERS

GUITAR

- Golden Series, 12 Watt.
- Std. Series, 20 Watt.
- Std. Series, 10 Watt.
- Std. Series, 25 Watt.
- Std. Series, 35 Watt.
- Std. Series, 50 Watt.
- Playmaster 102.
- Playmaster 103.

HI-FI MONAURAL

Hi-Fi	3
Mullard	3-3
Mullard	5-10
Mullard	5-20

HI-FI STEREO

Basic	2
Mullard	2-2
Mullard	3-3
Mullard	10-10
Philips Twin Valve	10
Playmaster Twin	10
Playmaster Twin	17
Playmaster	113
Playmaster Unit	2
Playmaster Unit	3
Playmaster Unit	4
Playmaster	101
Playmaster	105

P/A UNITS

Standard	10W
Standard	25W
Standard	35W
Standard	50W
Standard	100W
Transistor	10W
Transistor	30W

TAPE UNITS

- Stereo
- Stereo Adapter
- Stereo Phone Amp

PREAMPLIFIERS

- Transistor Mono
- Transistor Stereo

CONTROL UNITS

Playmaster No. 8	
Playmaster No. 9	
Playmaster No. 10	
Playmaster No. 104	
3-Channel Mixer	
Philips Magnetic	3V
Mullard	2V
Mullard	3V
Transistor Mono	
Transistor Stereo	

CONVERTERS

S/W Batt.	1
S/W Batt.	2
S/W A.C.	1
S/W A.C.	2
50 MC/S	
144 MC/S	
50-144 MC/S X'Tal Locked	
D.C.-D.C.	40W
D.C.-D.C.	60W
D.C.-A.C.	40W

INSTRUMENTS

3in.	C.R.O.
5in Wide Range	C.R.O.
Wide Band	C.R.O.

- Preamplifier
- R/C Bridge
- V.T.V.M.
- Electronic Stethoscope
- Sweep Generator
- Sweep Marker Generator
- Pattern Generator
- Diode Noise Generator
- G.D.O.
- Transistor Wave Meter
- Transistor Signal Tracer
- Transistor Pattern Generator
- Valve and Transistor Tester
- Millivoltmeter
- Distortion Noise and Millivoltmeter
- Mullard Tachometer
- Electronic C.R.C. Switch
- Geiger Counter

RECEIVERS

DXERS (Batt.)	1
DXERS (Batt.)	2
DXERS A.C.	2
DXERS A.C.	3
DXERS, 3 Band	3
Interstate	5
Fremodyne	4
Amateur RX	
Transistor	1
Transistor	2
Transistor	3
Transistor	4
Transistor	5
Transistor (R.F.)	7
Transistor	8
Transistor 3 Band	8

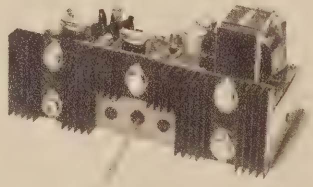
TRANSMITTERS

V.F.O.	1962
Remote V.F.O.	1963
144 MC/S A.M.	TX
144 MC/S S.S.B.	TX
1962 S.S.B.	TX
144 MC/S Linear Final	

MISCELLANEOUS

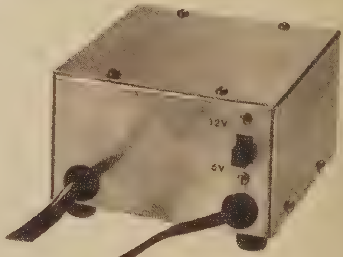
- Light Beam Relay
- Flasher Unit
- Regulated 9V D.C. Supply
- Universal Battery Charger
- Intercomm. Unit
- Metronome Unit
- Porta Player
- TV Hearing Aid

If you cannot see your project listed—write for a quote, we have many other units available or in development.

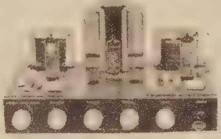


Playmaster 113

1966 VTVM

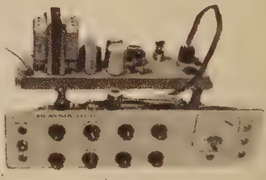


Battery Charger



Mullard Stereo 3.3

.103 Guitar Amp.



Playmaster 110 Tape Amp.

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232 FLINDERS LANE
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Phones 63-3596
63-5973

f the late John Peel, VK2WJ, presented to the division a library cabinet which had been constructed from the proceeds of the sale of John's equipment, which he donated to the Institute just prior to his death.

The cabinet will house, along with the books already held, the technical library of the late Gordon McLeod, VK2ADC, which has been given to the Institute by Mrs McLeod.

A.O.C.P. CLASSES

The next series of A.O.C.P. classes, designed to assist those interested to obtain their amateur operator's licence, will commence early February.

These personal classes are held two nights each week at Wireless Institute Centre, 14 Atcheson Street, Crow's Nest. Full details can be obtained by writing to the Class Supervisor at the above address. Radio theory and morse code instruction are included in the course.

In addition, a course by correspondence is conducted for those unable to attend the classes. Morse Code practice sessions are given each night of the week on 3550KHz on the 80 metre band commencing at 7.30 p.m. Morse Code practice tapes are also provided for those interested in learning the code. Details of this service can be obtained from Ern Hodgkins, VK2EH, Mangrove Road, Narara, N.S.W.

WICEN NOTES

More crystal frequencies for the conversion of disposal carphones have been received from Peter Campbell, VK2AXJ, WICEN publicity officer. These apply to the channel frequencies given in previous notes.

Channel	Transmitter	Receiver
A	4051.5KHz	78277KHz
B	4055.55KHz	78350KHz
C	4058.302KHz	78400KHz

The above frequencies apply to the Courier FM400/25 units.

Channel	Transmitter	Receiver
A	4051.5KHz	33788KHz
B	4055.55KHz	33825KHz
C	4058.302KHz	33850KHz

should be used in the conversion of the Pye "Ranger."

Channel	Transmitter	Receiver
A	12154KHz	33788KHz
B	12166.66KHz	33825KHz
C	12175.0KHz	33850KHz

converts the Pye "Victor" and "Premier" units.

For the model TCA 1675 use:

Channel	Transmitter	Receiver
A	4051.5KHz	43033KHz
B	4055.55KHz	43081KHz
C	4058.302KHz	43115KHz

Since these conversion frequencies were first published in the October Notes Peter has received inquiries regarding the channel 3, F.M. frequency 146.100MHz. This frequency is correct and does not agree with that used in Victoria.

Channels A. AND B do agree and operators travelling interstate should use those channels to contact the interstate net.

SOUTH WEST ZONE CONVENTION

At the South West Zone Convention, held at Wagga during the holiday weekend at the beginning of October, were amateurs and their families from Victoria and widely separated parts of New South Wales. Those the furthest from home were Peter Alexander VK2PA, from Port Macquarie; Geoff Whyte, VK2AHM, from Willow Point near Wentworth; and Fred Bail, VK3YS, from Melbourne.

The convention venue was at Lake Albert, one of the beauty spots at Wagga. Saturday saw the arrival of visitors and Zone members from the surrounding districts, followed by the Convention Dinner on Saturday evening.

The official guest at the dinner was Alderman R. J. Harris of the Wagga City Council, who welcomed the visitors to the city of Wagga and officially declared the Convention open.

Zone Officer Harry Cuthbert, VK2AEC, proposed the loyal toast and the toast to the W.I.A. and amateur radio. The response to the latter toast was made by Pierce Healy, VK2APQ, Federal Councillor of the N.S.W. Division and representing the Divisional Council.

Sid Ward, VK2SG, who spent quite a lot of spare time organising the facilities for the Convention, told of plans for the Radio Club at Wagga which had been recently inaugurated and had been issued with the call sign VK2WG.

Another guest at the Dinner was Mr E. Roberts, relieving Radio Inspector in the area, who told of some of the technical advances made in the electronics field.

The evening concluded with the screening of several colour films on satellite construction and launching.

The field day events were conducted on Sunday and included 144MHz Hidden Transmitter hunts and an all-band scramble. The results were:

First 144MHz Hidden Transmitter Hunt: Sandy Bruce-Smith, VK2ZEX.

Second 144MHz Hidden Transmitter Hunt: Don Haberecht, VK2RS.

Third 144MHz Transmitter Hunt: Trevor Hoodless, VK2ACZ.

All Band Scramble: Bill Mill, VK2AHV.

The organisers of the convention express their thanks to the following trade houses who gave technical data and prizes for the various events:

A.W.V. for technical literature and a Radio Designers' Handbook; Mullard-Australia for technical data and radio valves including a DB75 cathode ray tube; Lawrence and Hanson, a meter; Philips, Technical Data.

Some of the latest Single-Side-Band equipment from Japan was displayed by Fred Bail, VK3YS, and a Raytheon SBE model 34 transceiver operated by Pierce Healy VK2APQ, created considerable interest among those present. Many local and DX contacts were logged.

HUNTER BRANCH

During the holiday weekend at the beginning of October, the Hunter Branch conducted a most successful convention, the 15th since World War II.

The festivities commenced on the Friday night when the constructional competition was held in conjunction with the monthly meeting.

There was a smaller number of entries than in the past, and only four amateurs displayed pieces of equipment. The winner of the competition, decided by ballot of members present and a panel of judges, was Bill Munn, VK2ZWM, who described his dual transmitter and modulator for 144MHz and 52MHz bands. Bill was presented with a Radiotron Designers Handbook for his fine effort.

At the dinner, held in the Charlestown Community Hall on the Saturday evening, over 50 guests were present, including representatives of the Divisional Council, the I.R.E.E. and the P.M.G.'s Department.

The welcome to visitors was extended by Bill Hall, VK2XT. Ray Carter, VK2HC, proposed the toast to the Wireless Institute of Australia to which, Cyril Henderson, VK2CH, representing the New South Wales Divisional Council, replied.

The address for the evening was delivered by Lionel Swain, VK2CS, a well-known Newcastle amateur and a founda-

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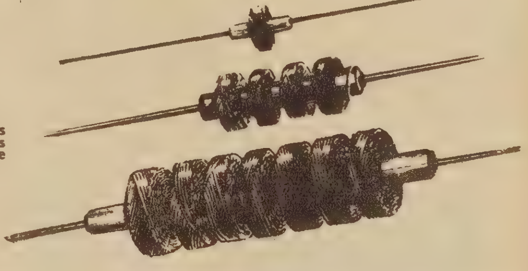

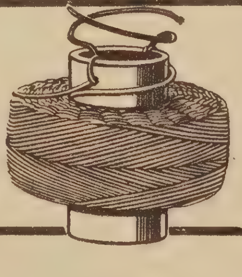

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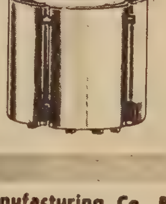

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Current: DC:0-300uA (2 ranges)
0-300mA (3 ranges) O-12A (2 ranges) AC: 0 to 12A (2 ranges)
Ohms: 0-200K 0-200 Meg (4 ranges)
Capacity: O-2000uF (5 ranges)
Inductance: 0-10,000H (4 ranges)
GM: 0-20,000 umhos
Decibels -28 to + 58 (6 ranges)
RF Volts: 0-1200 rms (4 ranges)
0-3500 p-p (4 ranges)

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Sensitivity: DC:20,000 opv
AC:5,000 opv.
Volts: DC:0-700 (7 ranges)
AC:0-700 (6 ranges)
Current: DC:O-50uA, 0-7-140mA
Ohms: 0-5-500K: 0-50 Megs.
Capacity: 0-0.03 - 0.6 uF
Inductance: 0-5-500H
Decibels: -20 to +59
RF Volts: 0-14 rms: 0-40 p-p

MODEL FN
PRICE: $31.50
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Sensitivity: DC:20,000 opv.
AC:10,000 opv.
Volts: DC:0-600 (6 ranges)
AC:0-600 (4 ranges)
Current: DC:0-50uA-12mA-300mA
Ohms: 0-10K: 1-10-100 Megs
Capacity: 0-0.03-0.6 uF
Inductance: 0-5000H
Decibels: -15 to +58
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Sensitivity: DC:6000 opv.
AC:2,700 opv.
Volts DC:0-600 (5 ranges)
AC:0-600 (4 ranges)
Current DC: 0-300uA: 0-12-300mA
Ohms: 0-20K:0-2-200 Megs
Capacity: 0-0-1-0-2uF
Inductance: 0-1000H
Decibels: -15 to +58
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tion member of the original amateur association in the Newcastle district.

Lionel spoke at length on the comings and goings in the area and in the process informed and delighted an attentive audience. He brought forward many hitherto forgotten or unknown facts about local amateurs, including several firsts in the field of radio. Lionel also made it clear that advances in techniques would only be made by continued experiment.

The Field Day at Bolton Point on Sunday, October 2, attracted a large crowd of amateurs and their friends and the full program of competitions kept those with prizes in mind busy for most of the day.

The morning 144MHz Hidden Transmitter Hunt and the High Frequency Band Scramble were won by the intrepid Dave Andrews, VK2AWZ, in fine style. The VHF Scramble resulted in a win for Widge Lowe, VK2ZWL, while Greg Partridge, son of VK2VU, won the afternoon 144MHz transmitter hunt.

The 7MHz transmitter was so cunningly concealed that it remained unfound and the prize went to its crew headed by David Russell, VK2BSC. The two pedestrian transmitter hunts provided some keen competition and were won by David Frazer and Michael Korsch, both Youth Radio Scheme members. Among the other prizes given was that for the technical quiz, won by Ian Forrest, VK2AJF.

Newcastle stations taking part in the Jamboree-on-the-Air report that a great deal of enthusiasm has been aroused in the "lost art" of signalling among the Scouts. Contact with stations around New South Wales and interstate gave the boys plenty to talk about and many of them have decided on early attempts for the "Wireless-man's" and similar barges.

In the case of the Mayfield group, who were the guests of Bob Blyth, VK2BOB, a very new activity will eventuate. Bob has agreed to instruct the scouts at their hall using a portable rig for demonstration purposes. In this way at least the Mayfield Boy Scouts will be tops in signalling in that area.

CENTRAL COAST BRANCH

At the October meeting of the Central Coast Section, held in the School of Arts, Gosford, on Friday evening the 21st, Ern Hodgkins, VK2EH, gave a very interesting illustrated talk on his recent trip around the South Pacific Islands. There were several visitors from Sydney and Newcastle at the meeting.

Plans have been finalised for the Christmas Party to be held at The Bistro, William Court, Gosford, on Wednesday, December 7, commencing at 7 p.m. Monday, December 5, is the deadline for bookings.

Another event to remember is the Field Day set down for a Sunday in February when all the events and facilities of past field days will be repeated, plus some.

Full details of the program and the date will be given in next month's notes. The thing to remember is that there will be a Field Day at Gosford in February, before making any other arrangements for a Sunday outing with the family.

On October 9 a plaque honouring the late Syd Colville was unveiled at Glenbrook, the mountain town where Syd lived for many years. The plaque was donated by his friend Frank Cary (VK2AMI) and is erected in the Glenbrook School of Arts. Picture shows Mr W. Williams, chairman of the Glenbrook School of Arts Committee, unveiling the plaque.

QUEENSLAND

Arising from a motion carried at the September General Meeting, and further investigation by the Divisional Council, it has been decided that a sub-committee of five members be formed to thoroughly investigate the establishment of a Memorial Place where the activities of the Institute can be conducted.

VALE

It is with deep regret that we record the passing of Donald Brader Knock, on October 31st, aged 68 years. Don had been a very sick man for some years before his death, and had had to relinquish his one-time consuming interest in amateur radio.

Before sickness overtook him, however, it was hardly possible to have been an active amateur without meeting up on the air with Don and his well known callsign VK2NO. In fact, Don's association with the technical and hobby side of radio dates a long way back when his name appeared as an editor and author in various technical publications, including the forerunners of this journal.

Don was a member of the Wireless Institute of Australia and the Institution of Radio and Electronic Engineers. He is survived by a wife and son, to whom we would express condolences on behalf of those who knew him among the amateur and technical fraternity.

Ipswich and District Radio Club

The timing of meeting nights for the Club has now reverted to alternate Tuesdays. This change became effective from November 4. The transmitting room at the club has been completed to house the Club station VK4IO.

SOUTH AUSTRALIA

The WICEN exercise held in October was planned to test the ability of the operators to relay messages quickly and accurately.

Twenty-three stations were in operation, located at Port Pirie, Snowtown, Clare Quarry, Clare, South Hummocks, Black Forest, the E.F.S. Headquarters, and Murray Bridges.

It has been reported that on the whole the exercise was a success, and steps are now being taken to rectify the errors that crept into the use of phonetics and the maintenance of net discipline.

As would be the case in an emergency, only whip antennas were used on the VHF mobile 53.1MHz equipment.

Members interested in joining the WICEN Group should contact Geoff Taylor, VK5TY, WICEN Co-ordinator.

Amateur Television

On Sunday, October 9, amateur television pictures were transmitted and received at good strength over a distance of 95 miles. Photos were taken of the received picture as a permanent record of the experiment.

Included in the transmitting group at Willunga Hill were Mait Lane, VK5AO, Rick Mathews, VK5ZFQ, and Andrew Pierson, VK5ZBP. The receiving station was manned at South Hummocks by Jim Wilcox, VK5ZGV and Edwin Schoell, VK5ZTS.

YOUTH RADIO SCHEME

In a recent issue of the N.S.W. Division Y.R.S. Newletter, attention was drawn to the policy of the W.I.A. and Youth Radio Scheme officers in relation to the use of AC power.

In an effort to emphasise the safety aspect, the policy is against the use of AC mains operated projects at the Elementary and Junior level and, as indicated in the Intermediate Syllabus, parental request will be required before AC operated projects will be accepted at Intermediate and higher certificate levels.

This applies, of course, to non-adults participating in Y.R.S. awards. Club leaders have been requested to explain this position very carefully to all members to make sure that parents are aware of the situation.

The Institution of Radio and Electrical Engineers has annually awarded an Efficiency Pennant for the Y.R.S. Club producing the greatest number of successful Certificate candidates. The Westlakes Radio Club has been recommended to the I.R.E.E. Council as the most efficient Club for 1966.

Congratulations go to Keith Howard, VK2AKX and his helpers for again winning this award. Thanks are extended to the Council of the I.R.E.E. for their continued support in making this trophy available.

RADIO CONTROL TRANSMITTERS

There has been recent publicity in the Sydney press about transmitters used for controlling model aeroplanes, model ships and similar devices. It appears that some imported equipment is designed to operate on frequencies other than those approved by the P.M.G.'s Department for these specific purposes. Consequently there is a risk that interference could be caused to other services.

It is pointed out that all radio-control transmitters must be operated only by persons holding the requisite licence or permit from the P.M.G. Radio Branch. Club leaders have been asked to bring this matter to the attention of all club members and to suggest that all Y.R.S. members contemplating the purchase of radio control equipment should contact the Radio Branch at Waverton and ensure that they buy only equipment which meets P.M.G. requirements.

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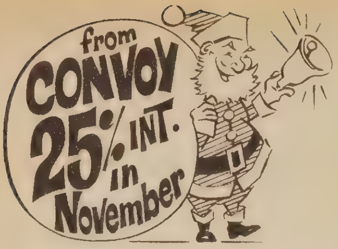

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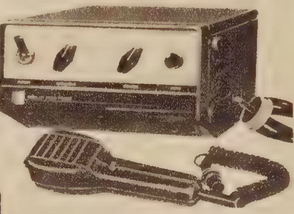

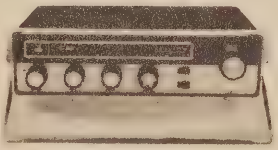

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Sony TC900, excellent cond., **$89.40,** save **$21.**

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AWA TR706, **$38.25,** save **$31.**

AWA TR201, **$54.00,** save **$37.**

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Free delivery on tubes, same day inter suburbs only

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Some Second Quality Tubes at only $8.00 plus dud.

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OSS HULL MEMORIAL CONTEST

he Federal Contest Committee of the Wire- Institute of Australia invites all Australian overseas amateurs and short-wave listeners participate in this annual contest, held to per- ate the memory of Ross Hull whose interest VHF/UHF did much to advance the art.

Perpetual Trophy is awarded annually for ipetition between members of the W.I.A. in itralia and its territories, inscribed with the ie and life work of the man it honours.

he name of the winning member of the .A. each year is also inscribed on the trophy. addition, this member will receive a suitably :ribed certificate.

lects:

Australian amateurs will endeavour to contact many amateurs as possible in Australia and rseas under the following conditions:

te of Contest:

From 0001 hours E.A.T., December 10, 1966, 2359 hours E.A.T., January 15, 1967.

ration:

Any seven calendar days within the dates men- ned above, not necessarily consecutive. These iods are to be at the operator's convenience. A calendar day is from 0001 hours E.A.T. to 59 hours E.A.T.

les:

. There are two divisions, one of 48 hours duration, and one of 7 days. In the 7-day division there are three sections:
  (a) Transmitting Open.
  (b) Transmitting Phone.
  (c) Receiving Open.

. All Australian and overseas amateurs may enter for the contest whether their stations are fixed, portable or mobile.

. All VHF/UHF bands may be used, but no cross-band operating is permitted. Operators are cautioned against operating transmitting equipment on more than one frequency at a time, particularly when passing ciphers. Cross-band operation to assist contest working is permitted. Such operation will be grounds for disqualification. Cross mode contacts will be permitted.

. Amateurs may enter for any of the transmitting sections. The seven-day winner is not eligible for the 48-hour award.

. Only one contact per band per station is allowed each calendar day.

. Only one licensed amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a contestant and must submit a separate log under his own call sign.

7. Entrants must operate within the terms of their licences.

. **CIPHERS.** Before points may be claimed for a contact, serial numbers must be exchanged. The serial numbers of five or six figures will be made up of the RS (telephony) or RST (CW) report plus three figures commencing from 001 for the first contact and will increase in value by one for each successive contact. If any contestant reached 999, he will start again from 001.

9. **ENTRIES.** Must be set out as shown in the example, using only one side of the paper. Entries must be postmarked not later than February 13, 1967, and clearly marked "Ross Hull Contest," and addressed to Federal Contest Manager, Box N1002, G.P.O., Perth, W.A.

0. **SCORING.** For all sections will be based on the attached table. Distances must be shown on the log entry as shown in the example. Failure to make this entry will invalidate the particular claim. Some typical distances are given in the attached table.

1. **LOGS.** All logs shall be set out as in the example and in addition carry a summary sheet showing the following information:

NAME .... CALL SIGN ......

ADDRESS .... DIVISION ......

CLAIMED SCORE ....

OPERATING DATES .... (7 calendar days)

Highest score over a 48-hour period was .... points.

Operating period from ...... hours E.A.T.

..../..../6 to ...... hours E.A.T.

..../..../6

DECLARATION: I hereby declare that I have operated in accordance with the conditions of my licence and abided by the rules of the contest.

SIGNED ....

DATE ....

12. Entrants not abiding by the rules of this contest will be disqualified.

13. The ruling of the Federal Contest Committee of the W.I.A. will be final. No dispute will be entered into.

14. AWARDS. Certificates will be awarded to the winners of each section in each VK and Overseas Call Area. The VK contestant who returns the highest score in the transmitting section and who is a financial member of the W.I.A., will have his name inscribed on the trophy which will be held by his division during the prescribed period.

A certificate will be awarded to the contestant, who shall not be the trophy winner and who returns the highest scoring log covering a period of any 48 consecutive hours. Also, certificates will be awarded for operating in the Ross Hull Contest and breaking any Australian VHF/UHF distance records.

Receiving Section:

1. Short-wave listeners in Australia and oversets may enter for the contest, but no transmitting station may enter.

2. Contest times and logging of stations on each band are as for transmitting stations. However, there is no 48-hour sub-section.

3. To count for points, logs will take the same form as for transmitting sections, but will omit the serial number received. Logs must show the Call Sign of the station heard (not the station worked), the serial number sent by it, and the call sign of the station being worked.

   Scoring will be on the same basis as for transmitting stations, i.e., on the distance between the listener's station and the station heard. See the example given. It is not sufficient to log a station calling CQ.

4. A station heard may be logged only once per calendar day on each band for scoring purposes.

5. AWARDS. Certificates will be awarded to the highest scorer in Australia and in overseas countries.

EXAMPLE OF TRANSMITTING LOG (Brisbane Station)

DATE/ TIME E.A.T.	BAND MHz	EMISSION POWER	CALL SIGN	RST/NR SENT	RST/NR REC'D	DIST. MILES	POINTS CLAIM
24th Dec. 0100	52	A3 (a) 50 watts	VK7ZAI	59001	59004	1110	1
0110	52	A3 (a) 50 watts	VK4NG	58002	57051	330	5
0230	144	A3 150 watts	VK5ZK	56003	55043	990	15
0235	144	A3 150 watts	VK3ZJQ	45004	46021	850	15

EXAMPLE OF RECEIVING LOG (Perth S.W.L.)

DATE TIME E.A.T.	BAND MHz	CALL HEARD	RST/NR SENT	STATION CALLED	DISTANCE (MILES)	POINTS CLAIM
2nd Jan. 1000	52	VK5ZDX	59221	VK8KK	1330	1
1025	52	VK2ZCF	58195	VK6ZAA	2040	5
1110	432	VK6ZDS/6	57061	VK6LK/6	60	5
3rd Jan. 0500	144	VK5ZHJ	44102	VK6ZCN	1330	20

SCORING TABLE

Distance between Stations (miles)	52MHz	144MHz	432MHz	576MHz	Higher bands
Up to 10	—	—	—	—	2
10+ to 25	—	—	1	2	5
25+ to 50	—	—	2	5	10
50+ to 100	2	1	5	10	15
100+ to 200	5	5	10	15	20
200+ to 300	10	5	15	20	
300+ to 500	5	10	20		
500+ to 1000	1	15	30		
1000+ to 1500	1	20			
1500+ to 2500	5	30			
2500+ to 3500	10				
3500+ to 5000	15				
Over 5000 miles	20				

DISTANCE TABLE

	SYDNEY	CANBERRA	BRISBANE	MELBOURNE	HOBART	ADELAIDE	N. ZEAL.	DARWIN	PERTH
SYDNEY	0	160	460	460	660	710	1300-1500	1950	2040
CANBERRA	160	0	600	290	530	670	1300-1500	1930	1940
BRISBANE	460	600	0	860	1110	990	1500-1700	1790	2240
MELBOURNE	460	290	860	0	400	400	1500-1700	1930	1720
HOBART	660	530	1110	400	0	710	1300-1500	2280	1880
ADELAIDE	710	670	990	400	710	0	1900-2100	1620	1330
NEW ZEALAND	1300-1500	1300-1500	1500-1700	1500-1700	1300-1500	1900-2100	0	2550	3000-3200
DARWIN	1950	1930	1790	1930	2280	1620	2550	0	1650
PERTH	2040	1940	2240	1720	1880	1330	3000-3200	1650	0

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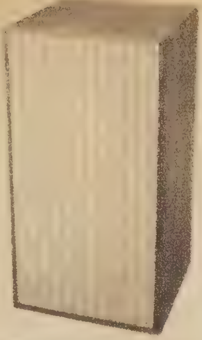

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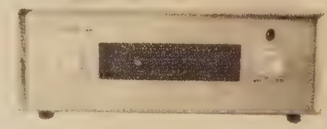

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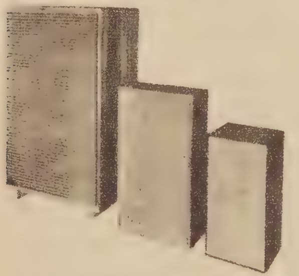

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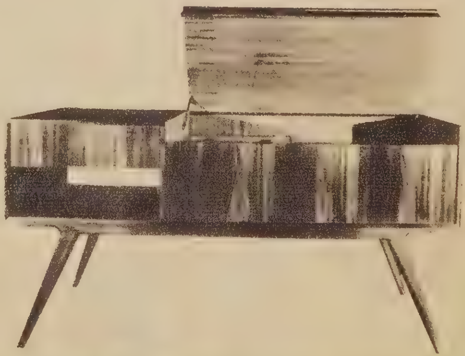

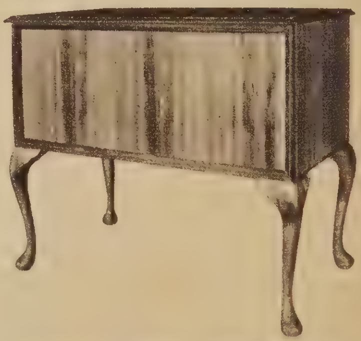

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LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

Reception Report on European Stations

This month we introduce a new feature, to be published in December and June each year, in which we will review the reception of European stations in Australasia.

The two publication dates will allow the mmer and winter periods of reception be covered, and this means daylight ception in winter and nighttime reception summer will be featured.

The new service is designed to help aders, in particular new Australians, who ish to tune to broadcasts from Europe, d the feature lists countries alphabetally for easy reference. Some countries o not cater for an international audience, ut may still be received here and the est listening times are indicated.

ALBANIA over Radio Tiriana has two ansmissions in English which give fair ception. The English program at 2000-MT is on 7090, 7265 and 9390KHz, and further session at 0630 is on 7265KHz.

AUSTRIA over the Austrian Radio at ienna has increased its short-wave services a world-wide audience. The transmissions Australia and New Zealand are now aily, and consist mainly of relays of the ome program, with announcements each our in German, French and English. The rvice to the Pacific has some English prorams scheduled, including the "Week in ustria" program, Friday 0930. Other Engsh features are fortnightly and monthly. he service is 0900-1100 on 17755KHz in he 16M band.

BELGIUM.—The Brussels transmissions or overseas reception are received well, but o English transmissions are broadcast. The est reception times are at 1000GMT when hey open to Africa using 15335, 17860 and 1510KHz, in French, Dutch and Congolse; 1215-1300 using 11825, 17750KHz in rench and Dutch; 1330-1545. on 15335, 7860 and 21510KHz; and 2115-2300 using 615, 9745 and 11870KHz in French and utch.

BULGARIA.—Radio Sofia, in its English ransmissions, is best received in its service o North America, 0400-0430 using 6070/700KHz. The service to Europe in English s broadcast 1930-2000 on 6070, and 2130-200, 0000-0100 also on 6070KHz.

CZECHOSLOVAKIA.—Radio Prague's ervice to the Pacific is on the air 700-0750, and is well received on 9505, 15285 and 21450KHz, while a transmission t the same time beamed to Europe is noted n 6055KHz. The North American service s on 0330-0420 and uses the new channel of 9720KHz. A service at 1200-1230 is on 560, 11960 and 15285KHz, while at 1900-1930 transmissions are on 5930, 7345KHz.

DENMARK.—Copenhagen has recently increased its services to the Pacific, and hey are on the air daily 0730-0815GMT, the balance of the 75-minute transmission eing in Danish. On Thursday it includes a bulletin of DX news in the English period. The frequency of 15165KHz is used for the session.

FINLAND.—Radio Helsinki is seldom heard in the Pacific area, but the best reception times noted recently have been at 0600GMT, when on 9555KHz and at 1000GMT when using 15190KHz. Rex Gillett in Adelaide recently reported the reception of the Finnish DX Club program over Radio Helsinki, on the 6120KHz channel, and reception was at 2100GMT on Fridays.

FRANCE.—O.R.T.F. Paris provides excellent reception in many of its French language programs, but its English transmissions are received at reliable reception level only in the service to the Far East. The service 0800-0900 in French to the Pacific is received well on 9620KHz. The English transmission to the Far East from 1300GMT is carried on 15240 and 17765KHz.

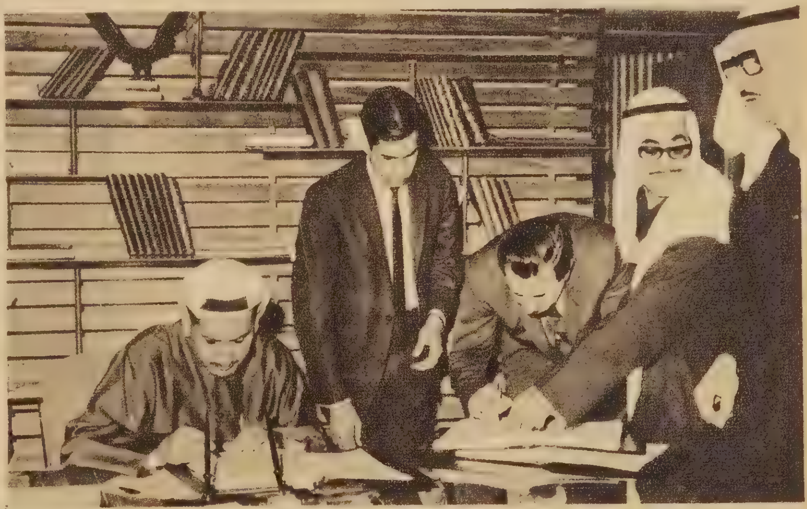
GERMANY (Federal Republic). — Deutsche Welle in Cologne provides reception for a world-wide listening audience. Its service to the Pacific area in German is broadcast 0645-0930 when it operates on 11795, 15205 and 17880KHz. The English transmission is at 0845-0940, using 11925, 15275, 17845KHz, and at 2110-2200 on 7290, 9685KHz.

GERMANY (East).—Radio Berlin International has programs for the Far East in English at 1200GMT when using 15255KHz, but they have also been noted at good level in the 13M band using 21610KHz. The station has world-wide services and frequently uses English in transmissions to various parts of the world.

GREECE.—The Athens Radio with its low power is seldom heard in the Pacific area, and though many of our readers wish to tune to Athens they have met with little success due to the low power used, and because the service, in the main, is beamed only to Cyprus and to Europe. Reception on Sunday during a church service relay at 0600GMT is possible on 9605 and 11720KHz. The service to Europe is 1930-2100 on 9605, 11720KHz.

GREAT BRITAIN.—The B.B.C. London, in its World Service, is on the air 23 hours a day, the silent period being 0800-0900. The transmission to the Pacific is divided into three special coverage times: 0600-0800 when they use 6110, 7150, 9510, 9460 and 11955KHz for early evening reception; 0915-1115 when using 11750, 15070, 17790 and 21550KHz for late evening reception; and from 2000-2245 when they have the morning service, using 7120, 9410, 11750, 12095 and 15260KHz. As well, the special regional service, known as the Pacific Service, is on the air 0800-0845 and broadcasts on 7120, 7150, 9640 and 11955KHz. In the winter months, this is carried 0630-0700 when the transmitters leave the World Service for this 30-minute program made up of special items of interest to listeners in the Pacific area. B.B.C. programs are relayed by the Far East relay station at Tebrau near Singapore in order to provide better reception in winter, when direct reception from London after 0800 is difficult.

HOLLAND.—Radio Nederlands is well received in the Pacific area in the special English transmission from 0730-0820 using 9525, 9715 and 11730KHz. On Sunday the "Happy Station" program is heard on the two channels of 9715 and 11730KHz. The sessions in Dutch are on the air, weekdays, from 0600-0720 on 6020 and 9525KHz, and a further session from 0830-0950 is carried 9715, 11730 and 21570KHz. On Sunday the "Happy Station" program with Edward Startz is repeated for Australian listeners 0730-0850 on 9525 and 11730KHz.



Kuwait has ordered from the Marconi Company three 750KW broadcast transmitters for its radio station, "The Voice of Kuwait." When these are in service, Kuwait will have the most powerful national broadcasting service in the world. Sheikh Jaber Al Aly, Minister of Guidance and Information for Kuwait, is seen here (left) signing the contract for the purchase of the transmitters. Also in the picture are (left to right) Mr Abdul Rahman Houti, deputy chief engineer, Ministry of Guidance and Information; Mr T. H. Gutteridge, of Marconi's; Mr Sa'adoun Al Jasim, under secretary; Mr Ahmad Sayyed Abdul Samad, assistant under-secretary for financial affairs.

University OHMETERS

Model E13 Blasting Circuit Tester is housed in a hard rubber moulded case measuring 6½in x 4¾in x 2¾in with sufficient resiliency to withstand hard shocks and is unbreakable. Two basic ranges are provided 1-15 ohms in red and 0/300 ohms in black, both ranges operating from 1.5 Volt 950 type cell with a maximum current flow on the circuit of under 14 milliamperes thereby ensuring operation conditions considerably better than permitted safety margin, when testing detonator circuits. Knife edge terminals are fitted to the top of the case so that quick contact of bare wires can be made.

The meter used in this Tester is Model R4, 4 inch heavy duty bakelite case easily readable scale of 3½" in length, and is protected from damage by the front protruding hood of the meter case. App. N.S.W. Mines Department.

Model EXT/2 is a portable self-contained Ohmeter which covers resistance reading in several ranges—0-20 ohms (2 ohms centre) 0-500 ohms (20 ohms centre) 0-5000 ohms (200 ohms centre) and on the lowest range of 0-20 ohms the first graduation is 0.1 ohms. The case of Model EXT/2 Ohmeter is of hard moulded rubber similar to that used in the Model E13, and incorporates the use of Model W4, 4 inch square meter, heavy duty acrylic case with easily readable scale of 3½ inches in length. Test Leads are stowed away in the plastic holder on the carrying strap for portability and a zero adjuster compensates for variations in voltage due to ageing of the 1.5 Volt type 950 dry cell which is easily replaceable by removing the hard rubber moulded back. With normal useage this battery should last from 6 to 9 months.

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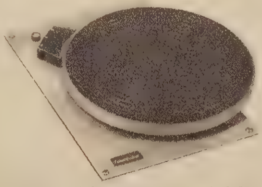

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Regarded as the finest ceramic stereo cartridge produced anywhere in the world, the Connoisseur SCU-1 will load any normal amplifier or tape recorder. Tip mass is 1 milligram, vertical compliance 8 x 10-6 cms-dyne, lateral compliance 12 x 10-6 cms/dyne. Sound qualities are exceptional—and include a pleasant musical transparency. Ask for copies of reviews in the "Gramophone" and "Records and Recording". **Encel price** **$10.80**

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This new arm has been favourably reviewed overseas . . . ask any Encel Stereo Centre for copies of the reviews in "Hi-Fi News", etc. Bearings are silicone grease damped and are single point pivot type . . . and an automatic raising/lowering device is fitted as standard equipment. Height is adjustable, the arm is easily mounted by means of a ⅝" diameter hole. Stylus force is adjusted by a set of precision weights . . . the counterweight is offset for dynamic balancing. Finish is polished nickel chrome and unbreakable black nylon plastic. **Encel price** **$18.50**

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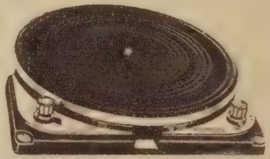

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HUNGARY.—Radio Budapest has a transmission in English to North America and this is heard 0430-0500 on 6140, 6234, 7220, 9833KHz. A service to Europe in English is broadcast 1930-2030 using 3995, 5902, 7105, 7305KHz. Programs in Hungarian 1900-1930 and to North America 0400-0430, are on the same frequencies, which carry the English transmission at 0430GMT.

ITALY—The R.A.I. transmissions from Rome are heard in several transmissions beamed to the Pacific over the Radiotelevisione Italiana stations. English transmissions 2205-2225GMT are broadcast on 11905 and 15310KHz. Italian is carried 0845-0910 on 11905, 11800, 9570KHz, and 2045-2110 on 11905, 11800, 9710KHz. Rome's service to Europe also gives good reception in English 2115-2135GMT on 11905, 9575KHz.

MONACO—Trans World Radio Monte Carlo is the best heard signal from this Principality, heard on 7290KHz on Sunday at 0630 to 0800. Radio Monte Carlo in French is heard at 0600 on 6035, at good level, with the local commercial programs being relayed.

POLAND—Radio Poland, Warsaw has two transmissions in English for the Pacific. The first is on the air 0730-0800 on 15275, 11840 and 9675KHz. The repeat at 0830-0900 is carried on the same frequencies. The service to the British Isles is carried in several transmissions including 2030-2100 on 7125, 5950KHz and 2130-2155 on 7145, 6135KHz.

PORTUGAL—Radio Nacional, Lisbon, has transmissions to this part of the world in English 0730-0815 when using 6180, 7130 and 11840KHz, while 1345-1430 the service to South Asia is in the 16 and 13M band on 17880 and 21495KHz.

SWEDEN—Radio Sweden in Stockholm has a transmission to the Far East at 1100 GMT, which is giving good reception on 15195KHz. This service in English includes the session "Sweden Calling DXers" in the Tuesday transmission at 1120GMT. Radio Sweden can be heard with a relay of its home program on 6065KHz from sign on at 0600 when all the transmission is in Swedish. A service to Africa in English at 1945GMT is also giving good reception on 11705KHz.

NOTES from readers should be sent to ARTHUR CUSHEN, 212 Earn Street, Invercargill, N.Z. All times listed are Greenwich Mean Time, add eight hours for Perth, 10 hours for Sydney and 12 hours for Wellington time. Frequencies are listed in Kilohertz.

SWITZERLAND has made some alterations for its service to Australia and New Zealand during our summer months, and the transmission has been retimed to 0900-1045GMT, when three frequencies are used, 15205, 17800 and 21520KHz. The service to Japan at 0700-0845 is also expected to give good reception in the Pacific area, and is carried on 11775 and 9675KHz. This transmission and the one at 0900GMT are in English, except for the period from 1015GMT, which is in Italian. The Berne transmission on 6165KHz, which uses 250 KW and is omni-directional, is also now being used for overseas service. The station is on the air 0600-2300GMT and in that period has an English transmission at 0700 GMT. The frequency also has programs in French, German, Swiss-German, Italian and Esperanto.

TURKEY is being heard on 17820KHz with a program in English 1415-1445 in a service to South and South East Asia. Another transmission has been noted from 2200-2230 using 15160KHz. The home program in Turkish from 0420 to 1300GMT is also being carried on 15160KHz.

U.S.S.R.—Radio Moscow transmission to Australia and New Zealand are well received, as are its services to other parts of the world. In the service to Australia and New Zealand they use both medium and short-wave frequencies for some of their transmissions. 2130-2200 on 11690, 9650, 9580, 9730, 7180, and 1250, 540KHz. 1130-1222, 11890, 9580, 7280 and 710, 620KHz. 1230-1300 on 9540, 7280 and 710 620KHz. 1330-1400 on 9540, 7280, 5960 and 710, 620KHz.

VATICAN transmissions to Australia and New Zealand are broadcast twice daily, at 2200-2220 and from 1130 to 1150GMT. In the summer months the service at 1130 gives the more reliable signals. The 2200 GMT transmission is carried on 9560 and 11740KHz, while the 1130GMT transmission is on 11760 and 15130KHz. Vatican can also be heard at 1815GMT with a further program in English and this is being heard on 9670 and 725KHz.

Another Vatican channel giving good reception is in the 13M band, on 21485KHz, which opens at 1000GMT, when the program is directed for reception in Africa.

YUGOSLAVIA—Radio Belgrave has its transmission to the Far East in English on 15240KHz, and is well received 1530-1600 GMT. Other transmissions at 1830-1900 on 6100, 7200 and 2200-2215 on 6100, 7500 and 9605KHz are also received.

NEWS IN BRIEF

MONTREAL USES 15365KHz.

Radio Canada at Montreal has commenced to use a new frequency in the 19M band in its service to Europe. The new channel is 15365KHz, replacing 15320 KHz, which has been in use for several years, but which now seems to be affected by severe sideband interference. The Montreal transmissions on 15365KHz are from 1215 to 1830, and are also carried on 17820 and 11720KHz for this period.

English transmissions are at 1215-1315, and news is carried 1515-1530GMT, while a service to the Canadian Forces is on the air 1631-1659. At the end of the 1830GMT transmission to Europe, a service to Africa is carried 1830-1945 on 17820, 15320, 11720KHz. A second transmission to Europe 2000-2152 is on 15320, 11720, 9630KHz.

PAPUA-NEW GUINEA STATIONS

The Territory of Papua and New Guinea is served by the Australian Broadcasting Commission at Port Moresby, as well as by stations of the Australian Administration and the newest of these stations, at Mount Hagen, is being widely reported on 2450KHz. Details of the stations and operating times and frequencies are contained on the verification. Samson Voron, Coogee, N.S.W., and others, send along this information.

Goroka VL9CG 0800-1100	2410KHz	250W
Daru VL8BD 0800-1100	3304	250W
Kerema VL8BK 0720	3245	250W
Wewak VL9CD 0615-1230	3355	10KW
Rabaul VL9BR 0600-1300	3385	10KW
Mount Hagen VL9CH 0700-1130	2450	250W

Most of the stations carry A.B.C. news at 0900GMT, and of the stations Wewak is the strongest at present, but other stations are also presumed to be scheduled for power increases. The only station still scheduled to be built in the area is at Madang but details on its operation are not known.

In a verification folder from VL9CH Mount Hagen, on 2450KHz with 250W, it is noted that the station serves an area in the Western Highlands with a population of 300,000. The folder also lists the new power of 10KW for Radio Rabaul on 3385 KHz. The Mount Hagen verification is signed by P. C. Pennington, Station manager.

ENGLISH FROM AFGHANISTAN

An English service for listeners in Europe has been reintroduced by Radio Afghanistan at Kabul, and this is on the air 1900-1930GMT, while at 1830 to 1900 the program in in German. The station uses the frequency of 11865KHz for this new transmission, and also is on 1522KHz for the same program. The home service is being carried on 4775KHz from 0230-0430, 1130-1330 and 1430-1730GMT.

The station has been also observed at 1400GMT with a further program in English for listeners in South Asia on 47775KHz. Verification from Radio Afghanistan is in the form of a post card, which is usually sent to the listener by registered airmail.

COLOMBIA USES 15325KHz

The increasing use of the higher frequencies by stations is shown by alterations announced by many broadcasters in recent weeks. The most recent of the Latin-Americans to move to higher channels is Radio Nacional in Bogota, Colombia. The station has now been heard on 15325KHz when opening at 1140GMT and again at 0200, to sign off at 0505GMIT. The station lists the 19, 31 and 49M bands as being used, so it is presumed this new frequency replaces 60M band outlet of 4955-KHz. The station includes transcription material from Voice of America, Radio Nederlands and the Swiss Short-Wave Service in Berne.

CHU TIME STATION

The use to which short-wave listeners put the standard-time-stations in their hobby are numerous, but mainly they use it for the correct calibration of their receiver and for setting their accurate clock by which they keep time when logging stations.

Radio CHU, which is operated by the Dominion Observatory of Canada, near Ottawa, is one of the most favoured of these stations, because its time announcements are given each minute. CHU is the descendant of the first time-station in Canada, which used telephone lines to distribute signals. In 1932 a 5-watt short-wave transmitter was added and the service has since

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N.Z.: P. H. Rothschild & Co. Pty. Ltd., 83 Pretoria St., LOWER HUTT. P.O. Box 30/170.

been expanded to three 5KW transmitters, operating 24 hours a day. The stations use 3333, 7335 and 14670 KHz, and announcements in English and French are switched in 10 seconds before each minute. The station at CHU was extensively modernised in 1958 to bring it up to the highest accuracy for its time and frequency transmissions, ensuring a world-wide reception of its services. It is used particularly for areas where WWV or WWVH are not received at good level.

TRANSMISSIONS FROM CAIRO

News on the times of English services from Radio Cairo, Egypt, is given in a recent schedule from the station. The transmissions in English are listed as follows:

2145-2315 to Europe	9475, 11965, 15135KHz.
0130-0300 to North America	9580
0130-0300 to South America	11710.
1300-1430 to South Asia	17695.
1930-2030 to East Africa	17695.
0630-0700 to Middle East	7075.

Reports from listeners should be sent to the Propagation Section of the United Arab Broadcasting System, P.O. Box 1186, Cairo, Egypt.

Cairo is using the new frequency of 11965 KHz, replacing 11915KHz, in the service to Europe. The trasmissions to Europe are on the air from 1745-2315, with Arabic, Italian, French, German and English. The frequency of 947KHz is also used for this period to carry the same program.

HIGH FREQUENCY NEWS

As we go to Press, an upsurge in the use of the 11 and 13 metre bands is apparent by European broadcasters, who now predict that the sunspot maximum could be six months earlier than at first supposed, and that April, 1968, could well be the peak of the 11-year cycle.

A review of some of the new signals noted on the 11 and 13M bands shows that many new countries are now using frequencies for the first time on 13M.

In the 11M band, the signals of the B.B.C., London, in the World Service are noted from 0900GMT when opening the 25650KHz outlet for South Asia; 25750KHz is still on a test basis; while a third frequency will be put into use by the end of the year. Oslo, Norway, is the other user of this band, with its services to the Far East on 25730 and 25900KHz from 1100GMT.

Sweden now uses the 13M band for the first time and is operating on 21690KHz, 0900-0930, in English to the Far East and again 1230-1300GMT.

The Radio Free Europe transmitters on this band are now numerous, broadcasting from the Munich area, and we note that 21665, 21730 and 21745KHz are the best received. Radio Portugal on 21495KHz is good at 0800 in English, to close down at 0900.

B.B.C. relays which carry the Voice of America program in Indonesian is best at 1100GMT when using 21530KHz. Berlin International on 21610KHz opens in English at 1200GMT but suffers from some interference from the B.B.C., London, on the same frequency. The B.B.C. World Service is using 21470, 21550 and 21710KHz from 0900GMT.

Vatican is strong in its English transmission at 1000GMT beamed to Africa when on 21485KHz.

VERIFICATIONS RECEIVED

MAURITIUS verifies with a yellow card from its studios at Forrest Side, reports Samson Voron of Coogee, N.S.W., and the card gives the schedule as 0230-1830 on 683KHz on medium wave, and the short wave service as 1300-1830 on 4850 and 0230-1300 on 9710KHz. The station has the power of 10KW and B.B.C. news is carried at 1800 when 683 and 4850KHz are in use.

COSTA RICAN station Radio Reloj TIHGB, in San Jose, in a verification letter, gives its frequency as 6205KHz, and sign off is now given as 0711 GMT. The station is also on 700KHz medium wave, 6205KHz on short-wave and 94MHz on frequency modulation, according to the station's letterhead.

TOGO, in a verification card, gives its schedule as Monday-Friday 0530-0800, 1200-1400, 1730-2300, on Saturday, 0530-0800, 1200-2300, Sunday 0600-2300, using 5047KHz and 7265KHz both with 100KW. English is heard at 2100GMT with a news bulletin.

HONDURAS station HRVC confirmed reception with a card carrying the station slogan "Radio Evangelica" and showing the power to be 5KW. This signal has been heard on 4820KHz most nights, opening at 1200GMT with usual devotional programs. Verification gives the station address as HRVC, Apartado 270, Tegucigalpa.

COLOMBIA station Radio Nacional which has been using the slogan "Radio Nacional Exterior Bogota" in its external transmissions, has verified our report on the new 15325KHz frequency promptly by airmail. The letter is signed by the Director and the address of this new station is Transversal No. 25-65, Bogota, Colombia.

BOLIVIAN station CP38 Radio Altiplano, widely reported in its all night operation on 5045KHz, confirms reception with a card and pennant. The address is Casillo 1081, La Paz, Bolivia. Verification signer is E. Aroz C. Director.

PUBLICATION REVIEW

The Pacific Asian Log, fourth edition, published by the New Zealand Radio DX League, has recently been compiled and published. This log covers the broadcast band stations in the Asian and Pacific area by frequency, with details of call, power, location, address, program network and sign-off time, as well as a list of stations arranged alphabetically by call sign. The 60 pages contain information on more than 1,750 stations listed in the Asian-Pacific area, 300 more stations than in the last edition.

The log has been compiled by A. Mervyn Branks, of Invercargill, an authority on reception in the Asian area for 30 years, and the log has been published by Des R. Frampton, of Invercargill.

The Pacific Asian Log is available from the New Zealand Radio DX League, P.O. Box 1356, Christchurch, N.Z. Price is 5/ per copy (N.Z. currency).

BROADCAST BAND NEWS

AFRICA.—A conference held in Geneva in September to draw up a frequency plan for stations on medium wave on the African continent has reached agreement in principal. This follows the breakdown of a previous meeting in Geneva, under the sponsorship of the I.T.U.

The conference concluded on October 8 with the signing of the agreement by 36 delegations from African countries, for medium wave frequency usage in Africa. The essential part of the agreement is the section covering frequency allocations. Until now, the continent has had no continental agreement for frequency allocations. The new plan provides for the operation of over 800 broadcasting stations in Africa, and will allow them to operate with a minimum of interference. The frequency band from 525KHz to 1605KHz will be used, divided into 121 channels, which corresponds to the European frequency plan. In other words, the metric system is used and stations are on 9KHz separation. Stations in Africa operating on the same channel will be located sufficiently far apart to avoid interference.

In addition to the allocation of channels, the plan also takes into account existing stations whose frequencies have already been registered with the International Frequency Registration Board in Geneva. The power range for stations in the plan is from 100W to 500KW. The conference was attended by about 180 delegates, and DXers can expect some major frequency changes to take place on the African continent when the plan is put into effect.

AUSTRALIA.—The following frequencies and powers of new Commercial stations for Queensland have recently been announced.

Gold Coast	1200KHz	2KW
Atherton	560	2
Innisfail-Tully	800	2

The new A.B.C. station for Cooma, 2CP, is expected on the air this month on 1570KHz using 50 watts. The four projected A.B.C. stations for Western Australia listed in a recent issue are not expected on the air for at least a year, or possibly two years.

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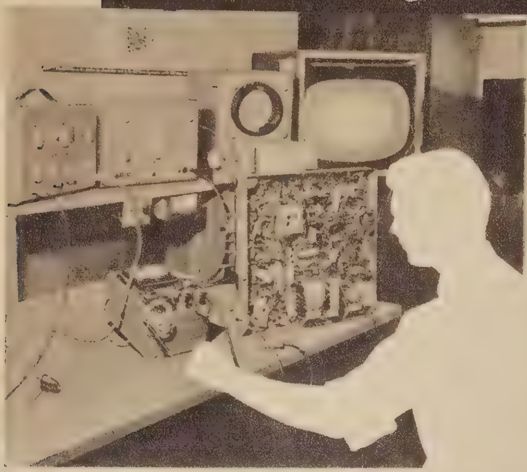

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by S. Hoberman

This outstanding TV servicing book starts special method of locating all types of circuit right out by showing the reader how to use this troubles and the other chapters explain how to apply these techniques to various receiver sections. (Cat. Code No. TVH-1) 4.10

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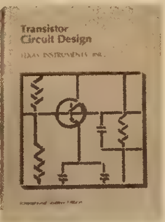
TECHNICAL BOOKS AND PUBLICATIONS

'ransistor Circuit Design

RANSISTOR CIRCUIT DESIGN, prepared by the Engineering Staff of Texas Instruments Incorporated. Published by McGraw-Hill Book Co., Inc., New York, 1963. Hard covers, 7½in x 10in, 523 pp., many circuits and diagrams. Price in Australia $15.75.

As the title announces this book is con- erned with circuit design involving transis- rs — mainly junction transistors. It was repared by the Engin- ering Staff of Texas nstruments in response the many applicat- ns queries and design roblems directed to em from transistor sers and designers. As is suggests it is a ook written by engin- rs, intended mainly r engineers and ad- nced technicians.



There is no attempt present detailed sign procedures for even a majority of rcuit problems and applications. Rather e present volume is intended as the first a series which will be selected and vised in the light of developments in both vices and circuit techniques. Nevertheless e present volume has quite a wide cover- e within the sphere of the junction tran- stor and its applications.

There are four main segments, dealing turn with Fundamental Considerations, C and Low-Frequency Designs, High- equency Designs and Switching-Mode esigns. As the total number of chapters rather high (39) I will not try to list all the titles; however the following sampling may serve to show the general scope involved.

Transistor Specifications (Ch. 3).
Measurement of Electrical Quantities and Parameters (Ch. 5).
Voltage Regulators (Ch. 9).
Chopper Amplifiers (Ch. 10).
Servo Amplifiers (Ch. 17).
AGC of RF Circuits (Ch. 24).
Digital Circuits (Ch. 28).
Switching-Mode Voltage Regulators (Ch. 36).

The book ends with a 26-page appendix dealing with the field-effect transistor, a section which may be of particular interest in view of the increasing popularity of these devices.

Throughout the presentation is of a very high standard. The text is smoothly and concisely written, the notation consistent and there are a great many illustrative diagrams. Sample designs are given in many instances to clarify various aspects of the design procedures and to show the significance of the various parameters and expressions. Many chapters conclude with a selected bibliography.

In short, the book seems to me to be an excellent design reference on transistor circuitry, and a volume which deserves a place on the shelf of any engineer in the field. It would also make an ideal text for the university or college student. I look forward to seeing the next volume in the series. (J.R.).

'ulse Electronics

ULSE ELECTRONICS, by Raphael Littauer, Ph.D. Published by McGraw-Hill Book Co., Inc., New York, 1965. Hard covers, 6¼in x 9in, 530pp., many circuits and diagrams. Price in Australia $13.40.

An introduction to pulse electronics, but e with a difference in that it is written a physicist rather than an engineer and intended ostensibly for scientists d other non-electronics folk rather than r those primarily interested in electronics elf. However it is, in fact, a well-written d highly readable book from almost any int of view, and one which would make excellent introduction for anyone seeking become familiar with pulse techniques.

The author is a research professor in e department of physics at Cornell Uni- rsity. He holds both M.A. and Ph.D. grees in physics from Cambridge. Not ng ago he spent a year in Australia work- g at the University of Sydney.

Throughout the book he places great phasis upon providing the reader with a ar and accurate conception of physical cuit operation. To this end the discussion fundamentally a qualitative one, but not the exclusion of mathematics. Sufficient the latter is given wherever necessary to rmit the reader to carry out a detailed alysis, should this be desired. In short, treatment is basically at a high-order scriptive level.

The background level assumed is moderate; on the electronics side the reader is expected to have a reasonable knowledge of basic circuit theory, together with a mathematical knowledge of about second year tertiary level.

RAPHAEL LITTAUER

Both valve and semiconductor circuits are discussed, the author drawing parallels where this is possible and otherwise pointing out the many dualities between the two.

Some idea of the wide scope covered should be conveyed by a list of chapter headings: 1—Introduction; 2—Linear Circuit Elements and Simple Networks; 3—Diodes; 4—Characteristics of Vacuum Triodes; 5—Triode Junction Transistors; 6—Biasing; 7—The Pentode; 8—Other Triode Configurations; 9—Nonlinear Miscellany: Switching and Logic Gates; 10—Negative Feedback; 11—Negative Feedback Amplifiers; 12—Positive Feedback; 13—Bistable Trigger Circuits; 14— Monostable and Astable Trigger Circuits; 15—The Blocking Oscillator; 16—Ramp Generators, Time Coding; 17—Coincidence and Transmission Gates; 18—Nonlinear Miscellany. 2: Registers, Counters and Matrices.

Most chapters include many illustrative circuit examples; all end with a set of problems. Many chapters are followed by data appendices. The book ends with a useful bibliography and index.

To summarise, the book would seem a very readable introduction to the pulse field, and one which might be a good choice not only for the sort of reader for whom it was intended but also as a basic text for electronics students at colleges and universities.

Our copy came direct from the publisher, but we understand that copies are available from all larger booksellers. (J.R.).

Textbook for Beginners

OUTLINE OF RADIO AND TELEVISION, by J. P. Hawker. Published by George Newnes, Ltd., London, 1966. Hard covers, 5½in x 8¾in, 399pp., many circuits and diagrams. Price in U.K. 30/.

A book which will probably be of considerable interest to parents and relatives at this time of year: an up-to-date basic introduction to electronics, intended especially for the young beginner with little or no mathematical background.

Its coverage is quite wide, and includes discussion of many recent developments. Apart from the usual basic electronic fundamentals there are chapters on valves and transistors, AM and FM radio receivers, power supplies, stereo, short-wave radio, television, colour television, tape recording, aerials, transducers, and so on. There are also sections dealing with circuit diagrams, components, printed wiring, technical abbreviations and simple concepts such as the decibel and time constants.

OUTLINE
OF RADIO
AND
TELEVISION
J. P. HAWKER

Presentation and readability are quite good; there are plenty of diagrams and circuits, and the text is quite clearly written. I must confess that there are various places where to me the author has either oversimplified the material or where the order of presentation seems somewhat less than logical. However I am fully aware that writing an introduction to such a field as electronics is one of the hardest jobs of all, and that "the perfect introduction" is in the same category as "the round square." As with most fields, the only way to get a really sound knowledge is to read not just one, but many books.

All things considered, the present volume is well deserving of an early place in the beginner's reading list. It would certainly make a very thoughtful and worthwhile gift for the erstwhile hobbyist and would-be engineer. (J.R.)

Oscillator Principles

PRINCIPLES OF ELECTRONIC OSCILLATORS, published by Techpress, Inc., Brownsburg, Indiana. Soft covers, 9in x 6in, 83 pages and illustrated with circuits and other diagrams. No Australian price is quoted but the American price is $1.95. Our review copy came direct from the publishers in the United States.

This little book, whose author appears to prefer to remain anonymous, is divided up into five sections, followed by a set of 32 exercise problems and a short index. The text is quite well written and explanations,

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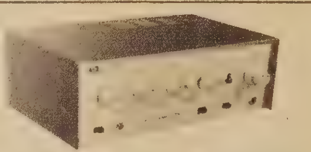

THE NEW PLANET MG-1504 STEREO AMPLIFIER

This extremely well finished stereo amplifier is also a fine performer . . . with a total power output of 15 watts (I.H.F.M.) and a frequency response of 30-20,000 c/s plus or minus 2db. Speaker matching for 4, 8 or 16 ohms. Valve complement 2 x 12AX7, 1 x 6AQ8, 1 x 6CA4, 2 x 6BQ5. Encel price is only **$59**

THE MK.II KELLY RIBBON TWEETER

Regarded as the most effective and advanced tweeter available for domestic speaker systems, the Kelly Mk. II is priced at only **$39.** The use of the Acoustic Lens to disperse high frequencies is recommended for improved performance.

SPEEDY MAIL ORDER SERVICE

Please give us your name and address in BLOCK LETTERS when ordering. All Encel equipment is BRAND NEW and Sales Tax is included in Encel prices. We care-pack and freight anywhere. Service is available at the Encel Service Centre in Melbourne and also at the Encel Stereo Centre, 257 Clarence Street, Sydney.

A NEW HIGH QUALITY TONE ARM AT A LOW, LOW PRICE!

The new Encel-Nikka tone arm is a precision instrument and will track perfectly down to ¼ gram with suitable cartridges. The open front head shell accepts all standard ½" fitting cartridges — and the arm takes Ortofon and SME shells without modification. Miniature ball bearings are used throughout. An outrigger bias adjustment sets stylus pressure. Encel price is only **$19 (£9/10/-).** Make your own comparisons with any other arms anywhere near the Encel price . . . **$19**

WHAT IS AN EMQ?

Because of trade agreements many prices cannot be advertised so we advise you to write to us for an EMQ . . . an Encel Mail Quote. Please print your name and address in BLOCK LETTERS . . . and, if you're writing for amplifier or tape recorder information, please be reasonably specific as our stock of these items is extremely wide. Help us to help you!

LOW PRICED SOLID STATE STEREO AMPLIFIER BY "SOUND"!

Just released! Model SAQ-202B . . . 6 watts RMS per channel, separate bass and treble controls, input sensitivity is 100 mV for pick-up, tuner and auxiliary. In attractive metal case. Frequency response is 30-20,000 Hz, plus or minus 3 db. 12 transistors. Encel price **$49** (£24/10/0)

NEW SYDNEY STORE A ROARING SUCCESS!

Conveniently situated on the Ground Floor of the 2SM Building at 257 Clarence Street the new Encel Stereo Centre in Sydney has become very popular with music lovers. A complete service centre has also been established at the same address. MAIL ORDERS . . . Because of the pressure of business involved in opening a new branch, please address all correspondence to Head Office, 431 Bridge Road, Richmond, Victoria.

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Music lovers owe it to themselves to compare the Leak Sandwich with any other speaker system . . . in performance and price. The new reduced price makes the Leak Sandwich better value than ever!

ENCEL WAREHOUSE STOCKS INCLUDE:

AMPLIFIERS: Acoustech, Leak, Sansui, Encel, Planet, Sound, Cosmos, Lux, Roland, Pioneer, etc.
SPEAKERS: Celestion, Kelly, Leak, Sonics, Chrysler, KEF, Wharfedale, Philips, etc.
TONE ARMS AND CARTRIDGES: ADC, Ortofon, Micro, Encel-Nikka, All Balance, JH, Pritchard, Decca, etc.
TURNTABLES: Connoisseur, Garrard, Lenco, Orpheus, JH, Labcraft, Thorens, Dual, Micro, PE, etc.
DICTATING MACHINES: Philips, Grundig Stenorette, Olympia.

EXCLUSIVE ENCEL OFFERS FOR DECEMBER

1. The new "Sound" 202B solid state stereo amplifier (6 watts RMS per channel), Labcraft 643 turntable with stereo diamond cartridge, two Wharfedale 8" speakers **$115**
2. Roland FAX-150 stereophonic amplifier with AM/FM tuners, Connoisseur turntable, Connoisseur SAU-1 tone arm with lift, Connoisseur stereo diamond cartridge, two Wharfedale 10" RS/DD speakers **$199**
3. The ideal budget system. Planet MG1504 stereo amplifier (8 watts I.H.F.M. per channel), Connoisseur turntable, Connoisseur tone arm w/lift and stereo diamond cartridge, two 8" RS/DD Wharfedale speakers . . **$134.** With a Labcraft 643 turntable and a B & O stereo diamond cartridge in place of the Connoisseur group price is only .. **$128**
4. Sansui Model 220 stereophonic amplifier with AM/FM/SW tuners, Connoisseur Craftsman III transcription turntable, Ortofon SMG 212 tone arm and Ortofon SPU-GT-E elliptical stylus cartridge, two Celestion CX 1512 12" co-axial wide range loudspeakers **$350**
5. Leak "Stereo 30", Akai 5000 or ADC 60 solid state stereo amplifier, Orpheus Silex turntable, Micro MA77 tone arm, ADC 10E elliptical stylus cartridge, two Celestion CX 2012 co-axial speakers. (The arm was reviewed in "Electronics" April, '66). Encel price only **$450**
6. The new Encel CSM-40 stereo amplifier, Labcraft 605 or JH turntable, JH MkII or Encel-Nikka tone arm, ADC 770 or Micro 2000/5 stereo diamond magnetic cartridge, two twin cone Wharfedale 10" RS/DD speakers **$229.** With the new COSMOS SW-30c stereo amplifier **$169**

Make up your own combinations . . . of any components you wish . . . and write for an EMQ. Encel prices are the LOWEST in Australia . . . and the service at Encel Stereo Centres is the best!

EARLY ENCEL SPECIALS AVAILABLE!

The special offers made from time to time by Encel Electronics in "Electronics Australia" are often kept open for several months. In many cases, the prices quoted are still applicable. Please check with us!

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iving the details of the operation of oscil- itors, are clear and easy to understand. it the same time, it is assumed that the eader has a good basic knowledge of the ehaviour of inductance and capacitance.

The first section deals with oscillator ieory and this covers a general discussion n the oscillator, dealing with the desirable haracteristics of oscillators. The parallel esonant tank circuit is discussed and backed p with several illustrations. Finally, the asic oscillator is shown in a block dia- ram.

In the second section, the Armstrong, erhaps better known as the "tickler" oscil- tor, is covered in some detail. This oscil- itor is used for the basic explanations, ther types of oscillator differing only in etail, mainly in the way that feedback is otained. Suffice to say that the treatment quite thorough, considering the overall ze of the book.

Biasing techniques are covered in the iird section and naturally, quite a lot of etail is devoted to the grid-leak method, ong with time constants. The various pics are well illustrated with circuits and iagrams.

Section four touches on output-coupling ethods and more particularly as the ethod affects the amplitude and frequency ability of the oscillator.

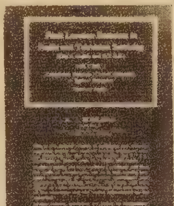
Various types of oscillators are covered the fifth section. Those mentioned are ie series-fed and shunt-fed Hartley, Col- tts and the electron-coupled oscillator.

One point of criticism should not be lowed to pass and that relates to the ioice of an illustration on the front cover. ere, a crystal oscillator circuit, using a ansistor is shown. This could be mis- ading, in that the book deals only with lf-excited oscillators and all illustrations e the valve. However, in spite of this, e principles still hold good, whether the rcuit uses a transistor or a valve as the nplifying element. To sum up, the con- nts of this work are interesting and should useful to students, amateurs and hobby- s.

Although no details are forthcoming, this ok should be available from booksellers the near future. (I.L.P.)

★ ★ ★

AULT LOCATION EXERCISES IN RADIO AND TELEVISION SERVICING, Volume 2, by K. J. Bohlman. Published by Norman Price (Publishers) Ltd., London. Soft covers, 61 pp., 8½ x 5½in, several diagrams and circuits. Price in Australia $1.30 plus postage.



While this book has en specially published a training manual r English students ining for a certifi- te in Radio and Tele- ion servicing, most of contents are applic- le to Australian nditions. Two of the ical circuits present- and analysed are for C/DC operation but, ain, many of the ints discussed apply r other types. In all, six fold-out circuit agrams of transistor and valve type ceivers are included in the book, printed such a manner that they may be re- rred to easily while reading the text.

The book is divided into two sections, first of which includes questions and swers on component function and circuit eration in typical receivers represented the circuits mentioned above.

The second section of the book poses estions on receiver faults which are likely be encountered in the typical receivers. swers to the questions with brief explana- ns are given at the back of this section.

This book is well compiled and should ove quite valuable to students of Radio Servicing. The questions included will certainly test the students' practical and theoretical knowledge of valve and transistor circuits and, in doing so, will indicate where further study of a subject may be required.

Our copy came direct from Technical & General Book Centre, 286 Chapel Road, Bankstown, N.S.W. (K.W.)

T.T.I. HOME STUDY COURSE

TECHNICAL TRAINING INTERNATIONAL Pty. Ltd., who are already established overseas, have begun operations in Australia in the field of Electronics Home Study Courses.

The concept of courses for home study on all manner of subjects, has been well established for many years now. Compared with other systems of tuition, much can be said for and against it. However, it must be conceded that there are many potential students who, for one reason or another, are unable to attend a college or university. Quite often, in such cases, the idea of studying at home, under the supervision of an accredited institute set up for the purpose, can be the answer to an otherwise insuperable problem.

In common with other systems of instruction, home study has been brought to a high standard and it is now possible to study very successfully a wide range of subjects.

Home study courses make it possible for a student to embark on the course of his choice, even though he may be located in a remote country area. Another advantage is that a student may begin a course at any time; it is not necessary to wait for a new year or term. Added to these, the student may proceed at a speed dictated by his own circumstances.

Technical Training International are offering two technical training programs. One course concentrates on the entertainment field. This includes radio, television, audio equipment, etc. The audio section also includes such aspects as tape recording, hi-fi stereo and public address equipment. The other course concentrates on industrial electronics, including the fields of business machines, computers, automatic control equipment, closed circuit television and other industrial applications.

Both programs start from the beginning with basic electricity and follow through to solid state devices. Each student is provided with the necessary tools, instruments, component parts, etc., as he progresses through the course.

The tool kit includes a soldering iron, set of screwdrivers, long-nose pliers, diagonal cutting pliers, adjustable wrench, tweezers, solder, punch and chisel, and heavy-duty pliers.

Among the instruments, are a power supply, multimeter and an oscilloscope.

Applicants for the courses are carefully "screened" and are only accepted if they show the requisite aptitude for the kind of work involved. This helps to reduce the possibility of persons taking on a course for which they are really not suited and which would only lead to disappointment. At the successful conclusion of a course, the student is issued with a detailed statement of qualifications and a diploma. A placement advisory service is also available to successful students who need assistance in finding suitable employment.

A well presented and prepared prospectus is available to persons who may be interested in taking one of these courses. This prospectus contains 20 pages, 11in x 8½in and is printed on glossy paper. The material which it contains should answer most of the questions which a prospective student may want to ask. Details of each syllabus are given, along with reproductions of the diplomas to be won.

A total of 52 papers covers the two courses but, at the time of writing, only two of the papers were available to us for review purposes.

Before commenting on the papers which we have examined, perhaps it would be best to mention that the courses are divided into five sections. Each of the two courses contains four sections. The first three sections are common to both, with section four completing the Radio and TV Electronics Program and section five devoted to the Industrial Electronics Program.

One of the papers which we have, is included in the first section on Introductory Electronics. The paper covers the subject of magnetism and runs into 39 pages of instructional material. This subject appears to be covered well and at a standard which could be considered as adequate for technician level. It is well written and presented, and includes many drawings and illustrations to get this rather no-so-easy subject across to the student.

The second paper which we have, is headed "Vacuum Tube and Semi-Conductor Diode." As the title suggests, it covers the theory of the thermionic diode and the semi-conductor diode. In addition, the application of these diodes as power rectifiers, is included; in other words, rectification and filtering.

In the 46 pages of study material, the subject matter is again well presented. This applies particularly to the subject of semi-conductors and the concept of "hole" conduction. We noted a number of printing errors but these will no doubt be corrected at the earliest possible opportunity.

At the end of each paper is an examination which must be completed by the student, who then returns it to be assessed. The examinations follow a modern practice where a question is asked, with several suggested answers immediately following. The student must choose the correct answer, which is not as easy as it may appear at first sight!

From a mechanical aspect, the papers are printed on good quality paper, with covers which should be durable enough to stand up to the usage to which they will be subjected. The now quite common method of plastic comb binding is used, which makes the assembly easy to handle.

Some of the names included in the list of technical staff, would indicate that preparation of the programs is in the hands of well experienced and capable men.

The writer is currently doing a similar type of course, at rather a higher level. At the same time, it is possible to make comparisons in presentation and T.T.I. is able to stand up to this scrutiny.

Further information may be had by contacting Technical Training International Pty. Ltd., P.O. Box 83, Double Bay, N.S.W. (I.L.P.)

ABC's OF ELECTRIC MOTORS AND GENERATORS, by Allan Lytel. Published by W. Foulsham & Co. Ltd., England. Hard covers, 128pp., 8½ x 5½in, well illustrated. Price in Australia $2.70 plus package and post.

The author, in nine chapters, endeavours to explain in simple terms the conversion of mechanical power to electricity and the

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Using the famous B&K signal injection technique, this effective all-in-one instrument provides d.c. power: tests power and signal transistors in or out of circuit: generates r.f. and audio signals; and includes a rugged, accurate multimeter. Four functions in one compact package with solid-state reliability and B&K professional quality.

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ıversion of electricity to mechanical wer. Starting with the laws of magnetism, author introduces the basic principles motors and generators, defines tne ious types, their applications and the erent methods employed to govern speed l direction.

Stated aim of the book is not to transm the reader into a generator/motor ert but to give him a broad picture how generators and motors function; nce the term "abc's of."

The chapters are headed as follows: roduction; Magnetic Fields and Electric rrent; DC Generators; AC Generators; Motors; Synchronous AC Motors; DC tors; Motor Control; Maintenance of nerators and Motors.

simple book for those interested in rning a little about the common electric tors and generators. Our copy direct m Technical & General Book Centre, Chapel Road, Bankstown, N.S.W. W.)

★ ★ ★

ANSISTOR SUBSTITUTION HANDBOOK, sixth edition, by the Howard W. Sams Engineering Staff. Published by W. Foulsham and Co. Ltd., England. Hard covers, 8¼ x 5½in, 127 pp., with diagrams and tables. Australian selling price $2.15 plus package and post.

The substitution table presented in this lication was prepared by feeding the a of all listed transistors into a computer. computer was programed to select nsistors with matching characteristics ithin set tolerances) and to group these possible substitutions.

The book includes a short chapter laining the necessary factors to be conered when making transistor substitutions. er this the book is split into five sections ed as follows: (1) Transistor Substitutes; Recommended Substitutes and Applicais, Alphabetical Listing of Applications; Germanium Diodes, Silicon Diodes; Terminal Guides, basing; (5) Key to nufacturers.

The tables are well presented and engirs or maintenance men, confronted with ipment using transistors from Japan, erica and England can speedily check locally available substitutes. Our copy ect from Technical and General Book ntre, 286 Chapel Road, Bankstown, .W. (K.W.)

TERATURE—in brief

TANDARDS ASSOCIATION OF AUSALIA requests comment on a draft Ausian standard for reference couplers for calibration of earphones used in audiory, issued as Doc. 1097.

his document prescribes requirements in ect of design, dimensions, construction, racteristics and calibration of the assem-, although it acknowledges that there ıot, as yet, international agreement on design of a true artificial ear to simulate edances of the average human ear and suitable for the calibration of earphones d in audiometry.

opies of Doc. 1097 may be obtained ıout charge from the headquarters of association, 157 Gloucester Street, ney, or from branch offices in capital s and Newcastle. Comments should h the association not later than Decem- 31, 1966.

BSERVED PHASE-FRONT DISTORN IN SIMULATED EARTH-TOACE MICROWAVE TRANSMISSIONS, H. B. Janes and M. C. Thompson, has n published in the U.S.A. by National eau of Standards as Technical Note , May, 1966 (96 pages, price in U.S.A.

his Technical Note presents an experital study of the time and space statistics he phase-front distortion of microwave als sent from a ground terminal to an ated terminal (air-borne or space teral).

To isolate atmospheric errors from random motion of the upper terminal, the latter was simulated by a series of mountaintop antenna arrays. Phase-front distortion was analysed in terms of time variations in radio range on a single path and in the first and second range differences from pairs of paths. The cross-correlations of (1) range variations on adjacent paths, and (2) range difference variations on both adjoining and separated pairs of paths are investigated, including the strong dependence of correlation on the portion of the power spectrum included in the data.

Remittances must be in U.S. exchange and 25 per cent should be added to the purchase price to cover mailing costs.

DUCON DIVISION of the Plessey Components Group has produced a six-page double fold brochure describing the range of Hivac dry reed inserts, with specifications and applications data. Also included is a section showing various modes of operation, and the types of spools available for relay coils.

Inquiries, on company letter head, should be addressed to Ducon Division, Box 2, P.O., Villawood, N.S.W.

EMERSON AND CUMING, INC., of Canton, Massachusetts, U.S.A., has produced new up-dated literature on Ecco passive radar reflectors. This literature describes in considerable detail the performance characteristics of the Bistatic Ecco Reflector, the Omni-Azimuth Ecco Reflector and the Omni-Directional Ecco Reflector.

Inquiries should be addressed to the Australian agents, Wm. J. McLelland and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W.

RONALD J. T. PAYNE PTY. LTD., 385-387 Bridge Road, Richmond, Victoria, has available a brochure describing the latest range of precision servo components made by their U.K. principles, Vactric Control Equipment Ltd. This range includes AC and DC servo motors, synchronous motors, AC motor-tacho-generators, resolvers, synchros and servo-gearheads.

STATE ELECTRICITY COMMISSION OF VICTORIA has published a brochure setting out the requirements relating to minimum clearance distances which must be maintained by law between structures and electricity supply lines. The Commission points out that radio and TV aerials are covered by the law. A copy of this brochure is available on request to the Commission's head office at 22-32 William Street, Melbourne, C.1.

STC COMPONENTS AND APPARATUS REVIEW, Vol. 3, No. 9 has a complete list of ITT semiconductor devices normally available through STC and its distributors; comprehensive data on ITT mercury wetted contact relays Type REL 300 (for printed circuit board) and Type REL 301 (Octal plug-in type); details of Silring power diodes for silicon rectification using the selenium stack method; data on the ITT Series EMK-40 capacitor motor; and product information about solid tantulum capacitors, midget relays, subminiature relays and dry reed relays. (Standard Telephones and Cables Pty. Ltd., Moorebank Road, Liverpool, N.S.W.)

PROCEEDINGS OF THE INSTITUTE OF RADIO AND ELECTRONICS ENGINEERS AUSTRALIA, Vol. 27, No. 10 (October, 1966) has articles entitled: Cross Modulation in TV Tuner Mixer Stage, by H. Wigg and B. H. Sheehan; The Resonant Behaviour of Certain Mechanical Systems and the Relation to Transmission Line Theory, by R. W. Harris; The Generation of Pseudo-Random Digits by the Method of Bit Computation, by E. G. Wormald; Design Aspects of a Coincident Current Core Store Insensitive to Drive Current Variations. (Inquiries to I.R.E.E. Australia, Box 3120, G.P.O., Sydney.)

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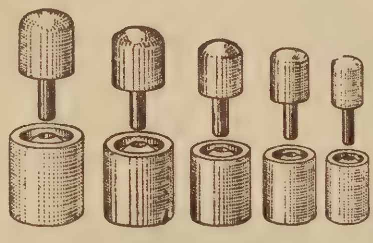

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11/16in	2.80	1¼in	5.20	2in	8.40	2¾in	12.40
¾in	3.00	1-5/16in	5.20	2-1/16in	8.60	3in	13.40
13/16in	3.20	1⅜in	5.60	2⅛in	9.00	3¼in	15.80
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The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg. in ½, 1 and 2 watt ratings and include some wire wound resistors. List price, $9.00 per 100. **Our price, $2.00 per 100.** Post and packing 25c extra.

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in standard values. List price, $11 per 100. **Our price, $2.06 per 100.** Post and packing, 35c extra.

The potentiometers are all current types and include switch pots, dual concentric and T.A.B. pots. List price, $12 per dozen. **Our price, $2.50 per dozen.** Post and packing, 25c extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Valve Type 6U7G, 6X5GT or IT4.

SPECIAL — OFFER

Complete KIT for TRANSISTOR 6 PORTABLE $17.50

The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Pack: extra. N.S.W., $1.00, Inter., $1.30.

NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	55c
XA102	OC44	Osc. Transistor	75c ea.
XB103	OC75	AUDIO general purpose	75c

Ducon type SFT 123 equiv, OC74 .. .. .. 75c ea.
Available in matched pairs at .. .. $1.50 pair
AUDIO OUTPUT
Post and packing on transistors 15c any quantity.

A.W.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturers stock E.H.T. units $5.00. Deflection yokes $5.00. Post free

NEW VALVES AT BARGAIN PRICES

1A7GT	95c
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6B8	$1.00
6C8G	50c
6F6	$1.00
6H6G	35c
6K7G	45c
6K8G	68c
6Q7G equiv, 6B6G	$1.00
6SA7GT	95c
6SH7	55c
6SJ7	95c
6SN7GT	95c
6SS equiv. 6SK7.	85c
6U7G	45c
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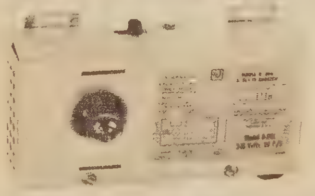

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Secondly to boost signal strength to two or three TV receivers coupled to the one aerial.

Full instructions supplied with each unit. 240 volt A.C. operation.

NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim. Supplied with 5in x 7in speaker in felt-lined enclosure Space for amplifier and batteries or power supply.

$11.50

Dimensions: 15in x 13in x 7in.
Post and Packing: N.S.W., 90c; Interstate, $1.20.

NEW MULTIMETER—$5.25

POST EXTRA
METER 0-1MA 1,000 OHMS PER VOLT
A.C. RANGES D.C. RANGES CURRENT
SUPPLIED COMPLETE WITH TEST LEAD
RANGE 0-100,000 OHMS

0—10v 0—100v 0—500v 0—500MA
0—50v 0—10v 0—1000v
0—250v 0—50v 0—1MA
0—500v 0—250v 0—100MA

EXTENSION SPEAKERS

$8.50

New 9 x 6 speakers in case.
Post: Interstate, 55c; N.S.W. 40c.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping Sec. 285 x 285 with 6.3v filament winding. 60mA, $3.00. Plus Postage: N.S.W., 35c; Interstate, 52c.

Prim.: 240v, Sec. 385 x 385 at 80mA, fil. 6.3 and 5v, $4.50. Post.: N.S.W., 40c; Interstate, 75c.

60mA H.T. Chokes, 75c. Post.: 20c.

T.M.K. MULTIMETERS

Before buying see our range of T.M.K. test instruments. As advertised in April issue of Electronics Australia.

NEW MIDGET POWER TRANS.

40mA prim., 240v. Sec 225 x 225 with 6.3v. Fil. Winding.

$3.25 Postage: N.S.W., 25c; Interstate 45c.

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

$3.25 Postage: N.S.W., 25c. Interstate 35c.

TRANSISTORISED SIGNAL INJECTOR, $5.50

A MUST FOR QUICK TROUBLE SHOOTING

Using TWO Transistors, complete with instruction sheet and battery. Post free.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

NEW TRANSISTOR SIX PORTABLE KIT

AT LESS THAN HALF PRICE

(DESIGNED TO SELL AT OVER £30/-/-.)

Excellent fidelity is obtained in this new kit set by the use of large speaker and polished timber case with attractive gold metal front panel. By using heavy duty batteries it is economical to operate and is ideal for portable use or that second set. Complete kit of parts is supplied with full instructions. CAN BE SUPPLIED WIRED AND TESTED AT £2/10/- EXTRA.

$23.75
(£11/17/6)

Post and packing N.S.W. $1.25 — Interstate $1.75.

mported National Transistorised Shoulder Megaphone

hese shoulder megaphones manufactured by National Radio Japan have an utput of 4 watts, and are supplied complete with inbuilt horn type speaker, atteries and microphone. List price $78.

Special Price $50. Post extra.

Other types also available.

NEW AMERICAN TWIN TELESCOPE TV AERIAL

Extends to 36in each section can be used singly for car or portable $1.50

Post 20c.

NEW 4-SPEED STEREO & MONO PLAYERS

AT LESS THAN HALF PRICE

PHILIPS 4-SPEED 6V BATTERY PLAYER

MONO $9.75
STEREO $11.75

Post and Packing, N.S.W., 75c.
Post and Packing, Inter., $1.25 Extra.

NEW GARRARD RECORD CHANGERS

These New English Garrard Changers with High Fidelity Crystal Pick-ups and Sapphire Styli have just been superseded. We are selling some at LESS THAN HALF PRICE. Available in STEREO at $25.50. POST AND PACKING EXTRA, N.S.W., $1.50; QLD., VIC., TAS., $2.25; W.A., S.A., $1.30.

USED HIGH-SPEED 240V. AC/DC MOTORS

These 240 v. a.c. or d.c. motors are 1/8 H.P. with a speed of 7,000 R.P.M. and are ideal for small drills, grinders, etc. Dimensions, 5½in x 3½in, with 5/16in spindle $3.75
Post, N.S.W., 50c; Interstate, 85c.

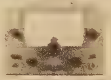
EW 4-SPEED STEREO
LAYER F.O.R. .. $17.50 (£8/15/)

NEW STEREO CHANGER.
4-SPEED F.O.R. .. $21.50 (£10/15/)

SLIDER-SWITCHES
10 pole 2-way silver plated contacts 38c

BROADCAST COILS & I.F. TRANSFORMERS.

Aerial, R.F. or Osc. coils 12/6 ea.
I.F. transformers 455K.C. 15/- ea.



LEADER SIGNAL GENERATOR LSG11

240V A.C. operated, 6 band 120KC to 390 Mess
Provision for crystal.
Post N.S.W., 75c; Interstate, $1.25. **$29.50**

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volt, with circuit for charger, $4.75. Post, N.S.W., 75c; interstate $1.00.
As above, 6 or 12 volt, at 2 amp., $2.75. Post, N.S.W., 35c; interstate, 45c. Transformer for above, $3.75. Post, N.S.W., 35c; Interstate, 45c.

NEW 240V. A.C. MOTORS

These small motors, size 5in x 3in x 3½in, are 1-12 h.p., but are only suitable for intermittent use. $2.95. Post N.S.W. 35c; Interstate 50c.

THE NEW COLLARO 3-SPEED TAPE-DECKS 2 & 4 TRACK

The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

3-speed 1⅞, 3¾, 7½. ● Pause control. ● Takes 7in. spools. Simplified controls. 4 Track, $48; 2 Track, $44. OSC Coils, $1.50

NEW EXTENSION SPEAKER

FITTED IN ATTRACTIVE LAMPBASE

FOR TRANSISTOR SETS.
SUPPLIED WITH LEAD and PLUGS TO SUIT MOST SETS.
(Shade not supplied.)

$5.00 (£2/10/-)

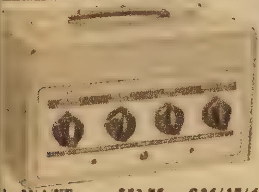
Post and packing 75c

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October. Electronics Australia complete with kit of parts including transistors mono **$7.50**, stereo **$13.00**, 240 power supply for above **$7.00**.

NEW 17 & 25 WATT P.A. AMPLIFIERS



WATT .. $53.75, £26/17/6
WATT .. $43.75, £21/17/6
Post Extra on 15 Watt N.S.W., 10/; Interstate, 15/.
25 Watt by Rail or Air. Too Heavy for Post.

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 ohms.

The 25 watt amplifier can be supplied with line output transformer tapped from 100 to 600 ohms if required at 20/extra.

Inputs provided for microphone, pick-up, and radio with mixing facilities and tone control.

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt) .. .. $6.75 .. 67/6

Crystal Microphones for amplifier .. .. $4.75 .. 47/6

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

RADIO HOUSE PTY. LTD.

306-308 PITT ST., SYDNEY. PHONE 26-2817

CAR, CARAVAN LIGHT FITTING

Auto light with switch fits any car, plugs into cigarette lighter socket. 6 or 12 volt available.

$3.75 Posted

Actual Size

"KEY LITE" $3.95

Free. One spare mercury cell.

With fob keyring, attractive gold finish case. Simply squeeze. Illuminates car and house locks, etc.

$4.00 Posted anywhere

MULTIMETER TESTERS

Model RH-50

Modern Design, 33 Micro Amp Meter.

30,000 Ohms per Volt D.C.

13,000 Ohms per Volt A.C.

1 p.c. Multipliers and Shunts used. Printed circuit.

Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 Ohms per volt.

AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 Ohms per volt.

DC Current: 0-.06-6-60-600 mA, 0-12 A.

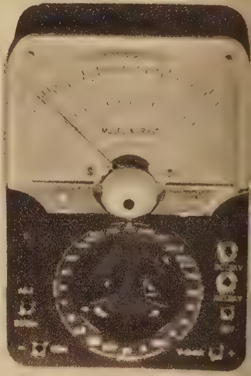
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).

Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW. 600 ohms).

Audio Out: Capacitor in series with AC volt ranges.

Short Test: Internal buzzer.

Accessory: 1 pr. heavy test leads.



Price $31 (£15/10/

Postage 50c to $1 extra.

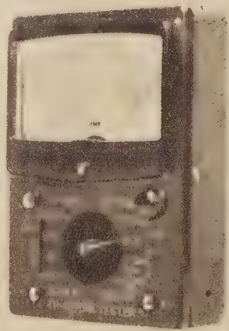
Batteries: 1 (1.5V), 1 (15V)

Size: 3 5-16" x 6 5-16" x 2

Weight: 1.4lb approx.

LIMITED STOCK ONLY

Model RH-10



RANGES:

DC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

AC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

DC Current: 0-500uA 0-500 mA.

Resistance: 0-10K-1Meg: 60 ohms, 6K ohms at centre scale.

Capacitance: 250uuF to 1uF, in two ranges.

Decibels:—20 to plus 36db, two ranges.

Output; 0-1,000 V in four ranges.

Size: 5in x 3½in x 1½in.

Weight: 13oz approx.

Price $10.75 (£5/7/6)

Postage 50c to $1 extra.

Model RH-31

Model RH-31

- 20,000 Ohms per Volt on DC.
- 10,000 Ohms per Volt on AC.
- 3½" Meter.
- 18 position selector.

SPECIFICATIONS

DC Voltages: 0-5-25-100-500-100 5000 (20,000 Ohms/V).

AC Voltages: 0-5-25-100-500-1000 (10,000 Ohms/Volt).

DC Current: 0-50 uA, 0-5-50-500m

Resistance: 0-6K-600K, 0-6Meg-60Me (30) Ohms, 3K, 30K, 440K centre scale.

Capacitance: 100uuF-0.01uF, 0.002u 0.3uF.

Inductance: 20 H to 2000 H.

Decibels: minus 20db to plus 30d in 2 ranges.

Output Jack: for Audio measure ments.

Dimensions: (3¾" x 5¾" x 2 3-8"

Weight: (23oz approx.).

Complete with internal battery an testing leads with prods.

$24.50

Postage 50c to $1 extra.

TRANSISTOR HEARING AID

First Phone Model 3 Transistors

This Hearing Aid is an ultra-modern unit. It incorporates the following outstanding features:

Ample power and clear tone.

Compact, smaller than a packet of cigarettes.

Precision printed circuit design.

Magnetic earphone.

Separate Tone and Volume Controls.

Battery used: UM5 dry cell.

Packed in a presentation case.

New Model $31.50

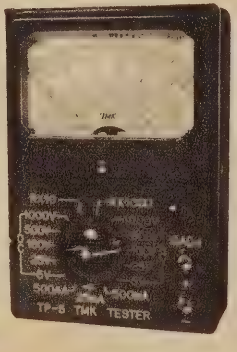
Replacement Battery only 12c.

Postage 50c extra.

MODEL TP-5 POCKET VOM. TESTER

RANGES:

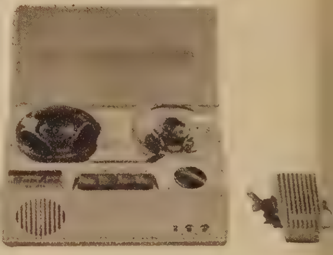
- DC Voltage: 2,000 OHMS per VOLT 0-5-25-100-250-1000 Volts.
- AC Voltage: 2,000 OHMS per VOLT 0 - 5 - 25-100-250-1000 Volts.
- DC Current: 0-500uA, 25uA, 500mA.
- Resistance: 0-20K, 0-2Mg. OHMS.
- Capacitance: 500uuF to 0.1uF at 100V AC, 0.01uF to 2uF at 5V AC.
- Decibels: minus 20 DB to plus 48DB in 5 ranges.



£5-17-6

$11.75

PORTABLE TRANSISTOR TAPE RECORDER



"SUNACE" PD 401

$21.00 (£10/10/-)

Postage 75c (7/6)

Complete with Mike, Battery and Tape.

STAFF WANTED

FOR OUR RADIO ELECTRICAL COUNTER

Enquiries phone 61-3832 or write to 306 PITT STREET, SYDNEY

ANSWERS TO CORRESPONDENTS

When writing to us:—

- **Please give your name and full postal address, including the State . . . N.S.W. &c.**
- **Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.**

FROM LAD OF 15

J. (Bellevue Hill, N.S.W.) says he likes our magazine but submits various suggestions for our consideration.

ank you for your letter. You've been stematic in your suggestions so let's be st as systematic in our observations. (1) ie cost of projects is largely relative to e prospective constructor and it is not reasonable for an advertiser to suggest at $60 is "inexpensive" for a stereo ampli- r kit — it is as stereo prices go. We ite realise, however, that there is a place r projects to match a schoolboy's budget d this is one of the reasons why we ve recently been resurrecting circuits likely be of use to lads who can win a dis- rded radio chassis from a friend or rela- e. (2) We prefer to leave the matter of ices to the people who actually handle rts. We could all too easily become in- lved in arguments about whether we did did not use "official" prices, whether should have quoted somebody's scounted price, whether we were dis- uraging business by setting estimates too gh, etc. (3) As we have said on several cent occasions, the contents of advertise- nts is substantially the advertiser's own siness. If you feel that certain advertisers not using their space to advantage, the ry best resource is to write to them and t your views. (4) We note your interest in "colour organ" device. Even a simple one ll strain your pocket money but, for any- ng capable of producing reasonable lour spectacle, you'd need some generous rental backing. In short, your ambitions ng this line are hardly consistent with ur initial case for cheap, simple projects! rry, but we have no circuits along this e to offer at the moment.

PHOTOFLASH

L. (Bardon, Qld.) says he much appreciated our article on photoflash and hoped that we would pursue it at least far enough to allow enthusiasts to convert old units from vibrator to transistor.

this time you will have seen our later icles, which would allow readers to do st that. Thank you for writing to us, how- er, and indicating that our thinking was ng the right lines.

ABOUT "HERTZ"

B. (St. Ives, N.S.W.) says that we should be following the British Standards for engineering practice which gives c/s as the abbreviation for cycles per second. He also suggests that accepted practice is to use the lower case "k" for kilo rather that a capital "K".

do not necessarily follow British ndards, being influenced by other ctice as well as by our own "house" style d typesetting facilities. These are very nificant factors in our case, because we part of an essentially newspaper organi- ion, with newspaper linotypes, characters, ctices, typesetters, readers, etc. One pub- tion, out of step with all the others, can d to a lot of confusion. We changed to Hertz because it is now adopted terminology throughout America and continental Europe, the CCIR being the most recent major body to adopt it. As for "kilo," we follow the practice we do, so as to adhere to the basic rule: multipliers greater than 1 get caps, those smaller than 1 lower case. Hence M-meg and m-milli.

VALVE EQUIVALENTS

D.L. (East St. Kilda, Vic.) suggests that we should "print a table for the conversion of European to American-Australian valve standards."

We take it that you have in mind a cross-index relating European type numbers to the RMA system, as used in Australia and America. This kind of information appears in certain valve manuals, notably those available through the Philips and Mullard organisations, and manuals of the ready-reference type, available occasionally through technical booksellers. We suggest that you check on these sources regarding availability and price. It is not the sort of information which we would normally publish in "ELECTRONICS Australia."

PERMAG. SPEAKER

R.D. (Geelong. Vic.) wants to know about using permanent magnet loudspeakers with old receivers originally designed for electromagnetic units.

This subject has been covered in the past but not recently. As you suggest it would be worthy of repeat cover in "Answer Man" and we will oblige at the first opportunity.

FERRITE HEADS

H. P. (Fawkner, Vic.) suggests that we consider publishing details of modifications required to use the new Mullard ferrite magnetic recording heads with the "Playmaster 110" tape system.

Many thanks for the suggestion, H.P., and we will certainly consider doing so as soon as it is possible. But don't expect to see any results for a few months, at least. At present we have a great stack of much-requested "priority" projects to wade through, not to mention a somewhat acute staff shortage. It'll take time, but we'll get there eventually!

LOUDNESS CONTROL

H. C. (Ipswich, Qld.) says he has built a No. 4 Playmaster which gives excellent results. He would like to add a loudness control, however.

There is no easy way to meet your request. One scheme is to use a tapped volume control with bridging circuitry, which modifies the response for different settings of the control. A good deal of experimental work would be necessary to adapt the idea for the particular amplifier since, to be effective, it must give the right contour at typical volume control settings; otherwise it could introduce more error than benefit. To add a separate loudness function would equally require examination and experiment, which we could not cope with at the moment. In the meantime, you can obtain equivalent results, very simply, by manipulating your tone controls so that you boost bass and treble at low listening levels, operating them nearer to "flat" at higher listening levels.

AUTOMATIC CAR CONTROL

R. C. (Ettalong, N.S.W.) has been giving thought to the automatic control of road vehicles. He thinks suggested schemes are much too elaborate and costly and suggests a guidance system involving a strip of reflective paint on the road, with cells which would sense when they diverted from the planned track and corrected the steering automatically.

We cannot claim to have expert knowledge in this field but we do know that road vehicle guidance is one of those subjects which starts out looking simple enough but which gains complexity as it is progressively up-graded to meet quite essential requirements of safety, road regulations, practical traffic movements, practical road usage, dynamic vehicle control and so on. Guidance is only part of the problem. The systems which you have apparently seen are complex, not because their sponsors want them to be that way, but because close study of the problem has made the complexities seem necessary. They are of such an order, at the moment, that automatic control of road vehicles belongs very much to the distant future.

"ELECTRONICS Australia" INFORMATION SERVICE

TO assist readers, "ELECTRONICS Australia" conducts a technical information service. Conditions governing this service are set out below:—

(1) Address letters to: Assistant Editor, "ELECTRONICS Australia," Box 2728, G.P.O., Sydney.

(2) Requests for copies of circuits or technical information requiring a postal reply must be accompanied by postal note or stamps to the value of $0-20 (2/-). Queries not accompanied by a fee will be answered in rotation on these pages.

(3) For the $0-20 fee, we will supply circuit data, as available, from our files. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuits will be answered more speedily if they are not complicated by questions requiring the attention of technical personnel. Where articles are not on file we can usually provide a photostat copy at $0-20 PER PAGE.

(4) The information service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits. Please note that the inclusion of an extra fee does NOT entitle correspondents to special considerations.

(5) The editor reserves the right to return fees or to limit the scope of an individual reply when it is felt that a partial answer will be better than none at all.

(6) In addition to the above service, chassis blueprints are available for most of our projects showing the position of holes and cutouts for metal-working, but containing no details of wiring. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost $0-50 (5/-) each. Original photographs of most projects are also available, from $0-50 for a 6in x 8in glossy print, postage $0-08 (9d).

(7) "ELECTRONICS Australia" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications should be obtained from advertisers.

(8) Technical queries are not answered by telephone.

(9) We have no file of circuits for commercial radio or TV sets, etc.

(10) A fairly good range of back numbers is available. On issues up to 6 months old there is a surcharge of 5c (6d). On issues from 7 to 12 months old the surcharge is 10c (1/-). Over 12 months, it is 20c (2/-).

HAM RADIO SUPPLIERS

5a MELVILLE ST., HAWTHORN, VIC. Phone: 86-646
8 PARK STREET, GLENFERRIE, VIC. Phone: 81-193
ESTABLISHED 194

JUST ARRIVED
CITIZEN'S BAND CRYSTALS

SUIT JAP WALKIE TALKIES

Available in standard HC 6/u holders, or HC 18/u miniature solderin type holder.

27.240 m/c $3.00
26.785 m/c $3.00
or $5.50 per pair. Either type.

MULTIMETER MODEL 200H

20,000 ohms per V. d.c. 10,000 ohms per V. a.c.

Specifications:
DC volts: 0-5, 25, 50, 250, 500, 2,500.
AC volts: 0-10, 50, 100, 500, 1,000.
DC current: 0-50 uA.; 25, 250 mA.
Resistance: 0-60 K ohms: 0-6 meg.
Capacity: 0.01-0.3 uF. (at AC 5v); 0.0001 - 0.01 uF. (at AC 250v).
Decibel: Minus 20 dB, plus 22 dB.
Output range: 0-10, 50, 100, 500, 1,000.
Battery used: UM3 1.5s, 1-piece. Dimensions: 3¼ x 4½ x 1⅛in.
Complete with internal battery, testing-leads and prods.

Price $10.75 inc. tax
Post 25c

HI-FI LOUDSPEAKERS

6 in twin cone, rated 5 watt, 60-16 Kc, 8 or 16 ohm available **$5.00, £2/10/0**
8 inch twin cone, rated 10 watt, 60 to 16 Kc, 8 or 16 ohm available **$7.50, £3/15/0**
12 inch twin cone, rated 10 watt, Ferrite Magnet **$10.00, £5/0/0**
6 inch Coaxial, rated 8 watt, 60 to 16 Kc, 8 or 16 ohm available **$11.00, £5/10/0**
8 inch Coaxial, rated 10 watt (40-16 Kc) 8 or 16 ohm available **$15.00, £7/10/0**
12 inch twin cone, rated 20 watt (30-13 Kc) 8 or 16 ohm available .. **$19.00, £9/10/0**

SPEAKER ENCLOSURES FOR ABOVE SPEAKERS AVAILABLE TO ORDER P.O.A.

MULLARD MAGNAVOX MINI BOOKSHELF SPEAKER BOX

(Mullard outlook, April, 1966, edition). Built by Approved Magnavox Manufacturer. Completely built and polished maple, walnut or teak.

With Speakers, each .. . **$27.00, £13/10/0**
F.O.R.

MICROPHONES

LM1. Crystal Lapel Type **$1.00, 10/-**
BM3, Crystal Pencil, Type w./on-off switch **$5.00, 50/-**
CM30. Crystal Small Tape Rec. Type **$1.95, 19/6**
DF2. Dynamic Tape Recorder Type 500HM or 50K available **$5.00, 50/-**
DF3. Dynamic Pencil Type 500HM or 50K available **$9.00, 90/-**
B1051. Dynamic Thin Pencil Type, polished aluminium finish. Response, 15-15KC 50K OHM only **$7.50, 75/-**
B1052. Dynamic Dual Impedance Pencil Type (600 ohm and 50K) (Response 15-15KC) **$11.50, £5/15/-**
B1053. Uni Directional Slim Pencil Type Dual Impedence (500-50K) (15-15K) **$18.00, £9/0/0**
B1401. Microphone Stand, Desk Type **$1.80, 18/-**

SEMICONDUCTORS TRANSISTORS

Germanium and Silicon

AC107	$1.90	BC108	.90
AC125/OC70	.90	BC109	$1.30
AC126/OC75	.90	BF115	.90
AC127	$1.00	OC26/AD149	$2.25
AC128	.95	OC30	$4.10
2-AC128	$1.25	OC35/AT1138A	$3.25
AD149/OC26	$2.25	OC44N	.90
AF114N/OC171	.95	OC45N	.90
AF115N	.95	OC70	$1.16
AF116N/OC170	.90	OC71/2N215	.75
AF117N/OC169	.90	OR 3 for	$2.00
AF118N	$2.00	OC71	$1.25
ASZ20/2N370	.90	OC72	$1.25
AT126/AC126	.90	OC74N/AC128	.95
AT310 Silicon	.95	OC75/AC126	.95
AT311 Silicon	.95	OC202	$3.00
AT312 Silicon	.98	2N217	.95
AT313 Silicon	$1.00	2N217/S	.95
AT314 Silicon	.90	2N370/ASZ20	.90
AT315 Silicon	.95	2N372	$1.75
AT316 Silicon	.95	2N410	.85
AT1138A/OC35	$3.25	26278 Delco	$3.00
BC107	$1.00	2N301 AWV	$2.30

Germanium, Silicon and Zener Diodes

BA100	.45	OAZ205	$1.50
BY100	$1.55	OAZ208	$1.25
OA5	.70	OAZ212	$1.25
OA79	.30	OAZ213	$1.25
OA90/OA80 1N34A	.30	OAZ222/BZZ14	$2.00
OA91/OA81	30	OAZ224/BZZ16	$2.00
OA200	.70	OAZ225	$2.00
OA202	.75	OAP-12 Light/sens 1N3194/OA210	.85
OA210/1N1763/ 1N3194 HR25, 400PIV, 400MA	.85	1N3193/OA605	.55
OA211/BY100/S1AR2 1000PIV 1 amp.	$1.60	1N3491 50PIV/18A	.95
AO605/1N3193	.55	IN3491R	.95
OA650	$1.10	1N3492 100PIV 18A	$1.20
OAZ200	$1.50	1N3492R	$1.20
OAZ202	$1.50	1N3493 200PIV 18A	$1.30
OAZ203	$1.50	1N3660 100PIV 25A	$1.55
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NSWERS TO CORRESPONDENTS—Continued

BULK ERASER

.U. (Sabah, East Malaysia) says that he has not had experience with bulk erasers but erases his own tapes by running them on high speed rewind over a permanent magnet. Provided the tapes remain in contact with the magnet at all times, erasure is complete.

is certainly worth considering where want to make sure, at short order, that races of the previous recordings remain any of the tracks. However, as you rve, DC erase does leave the tape in a ewhat noisy condition, which may or not be corrected when the tape is run the erase head in the process or rerding. Though we have not seen much he subject, there would seem to be the ibility of the magnetised tape inducing it magnetism into the replay head, with sultant increase in noise for future re- . Much would depend on the quality dards involved in the particular system.

COMPONENT PRICES

. (Bendigo, Vic.) writes to comment, among other things, on our policy of not quoting prices for components used in our projects — one which has been criticised by some readers in recent months. B. D. agrees with our policy and mentions the case of an English magazine which tried quoting prices, but had to virtually abandon the scheme after a few months, due to the volume of queries and complaints, answers to which needed up to two pages of the magazine each month.

ly thanks for your comment, B.D., particularly for the reference to the ish magazine. We were not aware of situation, our policy being a long ding one based on our own experience, it is gratifying to find it confirmed in a manner.

RECORDS—BACKWARDS!

. (Derang, Vic.) asks if records can be played backwards and if it involves consideration of the stylus angle, etc. He also wants to know the possible use of a tape loop in relation to something that has already been recorded on disc.

a modern cartridge you would not have orry about the stylus "digging in." In the stylus commonly has a negative when playing normally so that, played wards, it would actually be trailing. The r problem would probably be to reverse direction of the motor. By recording a d on tape, then replaying immediately wards through one or more replay heads cent to the record head, echo effects be obtained. The idea is exploited to extent by "pop" music groups and it l be applied to recorded music to pro- a synthetic echo effect. A characteristic e scheme is that the echo or echoes very distinct and multiple heads, with ection into the record circuit are often to multipy the number and complexity e echoes.

SHOCK FROM TRANSFORMER

(Mortdale Heights, N.S.W.) writes to say that he was testing an old mains transformer recently. He connected a 9-volt battery between the centre tap and one side of the 325 volt secondary. On accidentally touching between the centre tap and the other side of the secondary, he received a shock. M.T. asks, how could this happen?

reason for the shock is due to a omenon called "magnetic induction." principle is used as the basis for all formers. To receive a shock, the ry circuit must have been momentarily n. At this instant, the magnetic field e iron core suddenly collapses and es an instantaneous voltage in all ings, including the one that delivered hock.

NEW LOGIC GATE?

D. B. (Bendigo East, Vic.) sends in the logic diagram of a binary arithmetic "half adder" gate which he suggests as a much cheaper alternative to a gate shown in "Electronic Computers" by Henry Jacobwitz. He asks for our comments.

The laws of logical equivalence first stated by George Boole provide that there is almost invariably a number of different combinations of the basic logic elements which are capable of synthesising a given logical function. The digital arithmetic "half adder" being a combination of the "exclusive-OR" and "AND" functions, it is thus quite capable of synthesis using many different combinations of elements. Depending upon the manufacturing techniques used and application intended, certain of these may prove more attractive than others either from a cost viewpoint or from some other viewpoint.

Thus in some applications a NOR logic configuration of the type which you show may prove most attractive, while in others it may be less attractive. We imagine the book to which you refer used the configuration it did in order to provide a simple illustration.

Incidentally the NOR configuration which you show in your letter is quite often used in modern digital microcircuits. Thus we may make reference to this and some of the equivalent "half-adder" forms if in the future we publish an article on digital arithmetic. However, the present series of articles will not deal with such circuitry, being limited to a discussion of logic and counting as applied to digital instruments.

INDEX

R.H. (St. Ives, N.S.W.) is a junior reader who says he has received a lot of help from "ELECTRONICS Australia" in the fourteen months that he has been buying it. He suggest, however, that we should publish an annual index.

We do, R.H. in each March issue, which is the end of the Volume series each year. In earlier years, the indexes were less regular but we now try to put them in the March issue regularly. ▬

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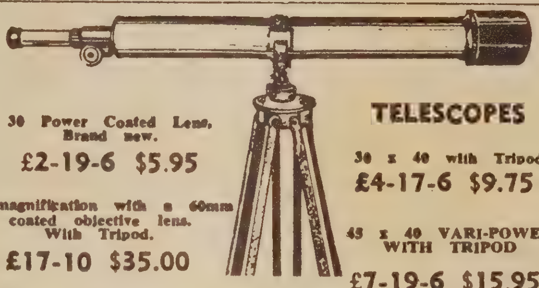

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SORRY, NO C.O.D.

diotelephone System

(Continued from page 29)

ersley Ranges. Survey teams selected ı sites on which the stations will be . These sites range from track level 000ft above the track and from as : as 300 yards to as far as 2 miles the railroad. Roads have been bull- d to the summit of the hills at all —150ft masts will be erected at four e sites with somewhat shorter masts vhere.

l equipment is 100 per cent transis- ed.

ie point-to-point system will operate diversity" mode. In this mode the h signals are simultaneously trans- d by two transmitters on different iencies and on different aerials loca- t different heights on the mast.

the next relay point, two receivers l to these transmitters are nually examined by a logic circuit h selects for onward transmission est of the two received signals. The ted signal is similarly transmitted duplicated equipment and examined ach relay point. Total failure can occur in the unlikely event that two vers or two transmitters fail on "leg" of the relay chain.

ie mobile talkthrough repeaters lso 100 per cent duplicated but, for ical reasons, only one set of equip- : can operate at one time.

ensure utmost reliability, an auto- : proving and changeover circuit will the station installation every five ites and effect automatic changeover her the receiver or transmitter does perate to required performance.

ie stations will be unattended and d only once each week.

ensure that adequate electric power ways available, storage batteries are ned which will supply the total n power requirements for a full ı days if both the wind and diesel e-driven generators fail to provide arging power.

wind - driven generator with an diameter propeller is expected to ide up to 70 per cent of the total ired electric energy. Should this fail, ltage-sensitive circuit will start up diesel engine when the battery is discharged. ▬

FORUM--Continued

w Hertz) wavelength is still refer- to, probably because, in the con- t of aerial systems and high pre- ncy "plumbing," the physical length a wave has a ready correspondence h the composite dimensions.

3y and large, the terminologies exist : by side, without too much embarrassment or confusion, and I imagine t's the way it will be with Hertz l cps.

t the risk of being repetitive and, briefly as possible, let me comment the points raised above:

1) It's not very likely that a lone stralian journal could reverse a ld trend. It's much more likely that increasing section of our readership uld, sooner or later, begin to chide us for sticking with outdated terminology.

(2) Yes, Hertz is just one of a number of new terms coming into wider use but it's the one which affects the greatest number of people. As we pointed out last month, it's largely a matter of familiarity and, once the terms get into our vocabulary, they will simplify text, as with amps, volts, ohms, etc.

(3) I imagine that the possible impact of Hertz on other sciences has already been considered.

(4) The question of abbreviation is not a major factor — but it is a factor in favour of Hertz!

(5) The move to standardise terms on a world basis has received its prime support from international bodies, standards groups, universities, etc. Magazines throughout the world are following suit. Judge for yourself about "snob" appeal on our part.

(6) Perhaps it amounts to stating the obvious but there is no connection between our efforts at systematising and standardising the text and the physical quality of the printing and paper. This is purely a matter of printing facilities and cost of production, related to the revenue we can expect from counter sales and advertising.

(7) In this particular context, the call to "be Australian" borders on the absurd. If the remark has relevance for Hertz, then we should also be agitating for the displacement, in local literature, of volts, amps, farads and even henries, none of which has a particularly Australian association. Boomerangs, wallabies, wombats? Bunkum! ▬

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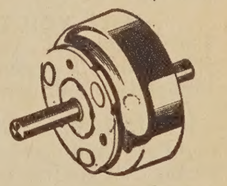

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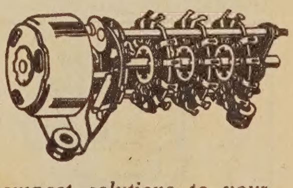

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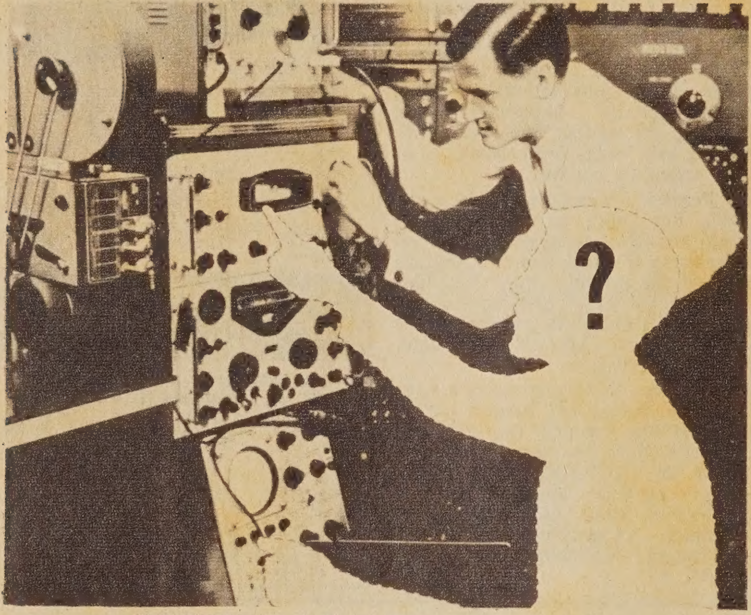

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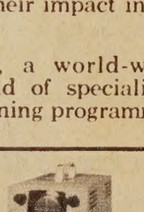

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EA

Flash—continued

tor circuit, since there could be a sl
difference in potential between the f
head/camera combination and case.

Any risk of this is best overcome
insulating the can of the electrol
from the carrying case. We were a
to do this very conveniently by me
of another short length of the shrink
plastic which we used to encase
battery. This was a fairly close fit o
the can and made an excellent job.

We have asked the importers
plan to market the capacitors to try
arrange for them to be similarly she
ed, but we are not sure whether
will be possible.

Assuming that the individual must
the job himself, it should not be
difficult. Plastic insulation tape, wo
spiral fashion, should do a good
but it would be as well to apply
layers near the bottom, where the cl
is fitted. The bottom of the can n
also be treated in some manner.

The end result of this small ex
effort is well worthwhile. Some idea
the improved trigger circuit can
obtained from the figures already quo
but the most impressive demonstrat
is the practical one. With the thyris
in circuit it is virtually impossible
detect any spark, even under subd
lighting conditions, when the trig
circuit is closed; a performance wh
contrasts markedly with the conv
tional trigger circuit.

Finally, a few words about the pho
graph at the beginning of this arti
Our aim was to capture a "pose" wh
was characteristic of the butterfly str
and, initially, we imagined that
would require only a high shutter sp
and bright sunlight.

Since things happen much too f
to allow focusing "on the run,"
planned to make the best possible e
mate of distance, then provide as mu
depth of field as possible to offset mi
errors.

But a couple of dry runs revea
a number of problems. No matter h
carefully the swim was planned, it
virtually impossible to ensure that
required "pose" would occur at a
nominated distance. And, at a shut
speed of 1/500 second and a stop arou
f8 to f11, the depth of field just was
good enough. The smallest stop, f
was closer to our requirements,
would have produced a hopelessly un
exposed negative.

It was at this point that the id
of supplementing the sunlight with fla
was considered. It was calculated th
at the estimated distance of 10ft, the f
output of the flash would be sufficie
at f22, to provide a reasonable exposu
in its own right. If the sunlight help
a little, so much the better.

The idea worked extremely well. Thr
exposures were made, one bei
very similar to the one reproduced a
one being less satisfactory only in
pictorial sense.

This story emphasises one of the mo
important uses for electronic flash; as
supplementary light out of doors to
in shadows, work against the light, a
help stop action. Once you have us
it in this role you will wonder ho
you ever did without it.

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vity and sig./noise ratio. No alterations
eiver necessary—output of unit connect to
er aerial socket. Power gain 25dB. Recep-
f distant stations made clear. Stops fade.
rice 35/ ($3.50). Prompt service. Harrard
onics, Box 58 P.O., Campsie, N.S.W.

Lansing 15in duplex speaker with
ing 60 watt Trimax amp, price $200. Ph.
'88 or write to M. R. Thomas, 608
w Rd, Grange, S.A.

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erial: 300 miles. Operates speaker. Ideal
Bargain price 99/6 ($9.95). Wired and
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Why, N.S.W.

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stations, etc., etc. Freq.: 3.5-12MC. 3
stors. Veroboard construction. 9V operation.
omplete inc. instruction. Ideal gift. Special
89/6 ($8.95). Wired and tested 99/6
5). Kit-Sets Aust. Box 176, P.O. Dee
N.S.W.

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nstructions. Price 38/6 ($3.85). Guaran-
Kit-Sets Aust., Box 176, P.O. Dee Why,
/.

-WAVE RECEIVER BOOSTER KIT. Enables
t stations to be received clearly. Stops
Power gain 28dB. Freq. 3.2-12MC. Size
ong, 1½in wide and 1¼in high. Output
cted to receiver aerial socket. Price 45/
0). Wired and tested, $5.50. Kit-Sets
Box 176 P.O., Dee Why, N.S.W.

ransmitter. Heathkit HX-20, 5 bands, per-
order; had little use. $200. W. J. Bell,
ood Park, Wangoom, Victoria. Telephone
here 94-225.

compass Bendix MN26, 12 volt with
cessories. £25 or exchange for "O" Gauge
stock. 42 Cambridge Ave., Vaucluse,
/.. 37-3264.

Sig. gen. 100-150/MHz suit aircraft radio
e. New X-disposal. With field strength
r, tuning met., tool kit, book, in solid
.. Bargain $50. George Harrison, 3 Dell-
St., Bankstown, N.S.W.

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Hwy, Applecross, W.A.

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years old. Retail $81.90, selling for
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, wil sell £90. Complete TV course £17,
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istor reg. power supply and valve tester.
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sories. Country inquiries welcomed.
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hfield, N.S.W. 642-4215, Sydney.

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er" Recording Tapes. Tensilised in sealed
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